IN THIS ISSUE—HORSEPOWER FACTS AND FALLACIES

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# The AUTOMOBILE

Vol. XXXVI
No. 17

NEW YORK, APRIL 26, 1917

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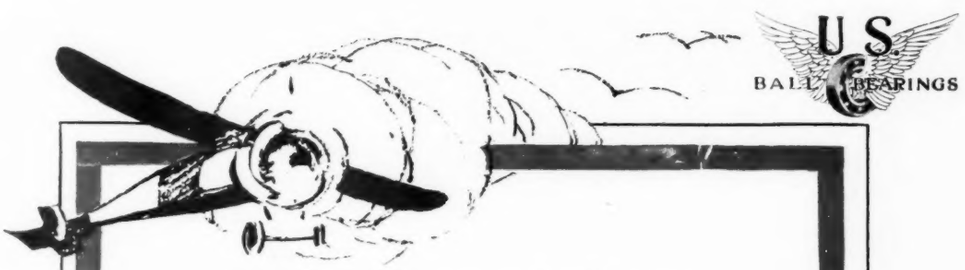

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AUTOMOBILE

# Van Sicklen

ELGIN

# SPEEDMETERS

## Built to the Quality Standards of the Elgin Watch by Elgin Watchmakers

*The Van Sicklen Company*
*Elgin* *Illinois*

*Service Stations in practically every City in which VAN SICKLEN equipped cars are marketed*

The Automobile

Vol. XXXVI New York—Thursday, April 26, 1917—Chicago No. 17

# United Motors Earns $9 a Share

## $23,500,000 Sales in 9 Months —$40,000,000 Sales Expected for 12-Month Period

New York, April 23—Gross sales of the United Motors Corp., for the 9 months ending March 31, totaled $23,500,000, as compared with $17,200,000 for the same period ending March 31, 1916. It is estimated that sales for the fiscal year ending June 30 will be $40,000,000, an increase of 40 per cent over last year. A complete operating statement will be issued immediately after the close of the fiscal year.

Earnings are at the rate of $9 per share, this in spite of increases in the cost of labor and materials, and it is stated that the company has contracts and orders in hand to insure full operation of the various units up to July 1, 1918.

The United Motors Corp. was formed in May, 1916, with the following companies as a nucleus: Perlman Rim Corp., New York and Jackson; Dayton Engineering Laboratories Co., Dayton, Ohio; Remy Electric Co., Anderson; Hyatt Roller Bearing Co., Newark, N. J.; and the New Departure Mfg. Co., Bristol, Conn. The capital involved was $60,000,000. Subsequently, the Harrison Radiator Corp., Lockport, N. Y., and the Klaxon Co., Newark, N. J., were taken into the company.

All of these plants are at present in a flourishing condition. The Harrison Radiator Corp. has booked orders for between $5,000,000 and $6,000,000 for delivery beginning July 1, 1917, and is building extensiye additions to its plant. The new plant of the New Departure Mfg. Co. will be in production in June; this will considerably increase the earnings of the company.

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### Webb Bill Favorably Reported

Washington, D. C., April 23—The Webb bill, permitting American exporters to combine to obtain export trade, has been favorably reported by the House Judiciary Committee. The bill is designed to permit combination of American firms so they can compete in foreign trade with European countries. This applies, especially to South America, where German firms for years have taken much of the export trade because they were encouraged to combine and offer a combination price to purchasers. The American firms were forced to bid as individuals.

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### Engineers Start Enlisting

New York, April 23—The First Regiment, Reserve Engineers, the organization formed by the engineering societies, has started the work of enlisting, which is expected will be finished by May 1, when the command will be ready to take up training under army officers. Men wanted include chauffeurs and machinists. The regiment has an office at 29 West Thirty-ninth Street.

### Mechanical Defects Disclosed in War

¶ *Next week W. F. Bradley, special correspondent of* The Automobile *with the allied armies on the Western front, will describe in detail the principal troubles and defects discovered in trucks and passenger cars used by the armies, particularly those in the Italian service.*

*Having been in very close touch with every phase of motor transport almost since the start of the war, Bradley has been able to study almost every kind of mechanical failure of every make of machine in use. His criticisms of design are all constructive and he does not omit to say what is good while outlining what is bad.*

*Without question, this article is the most informative of any which we have yet had from Bradley's pen.*

# F. T. C. Reports on Gasoline

## Finds S. O. Dominates Industry—Demands That Congress Fix Standards

Washington, D. C., April 24—The long-deferred report of the Federal Trade Commission on the price of gasoline was transmitted to the Senate today, and the finding of the Commission is that Standard Oil interests substantially dominate the gasoline industry—refining, pipe line transportation and marketing.

Despite dissolution of the so-called "Oil Trust" by the U. S. Supreme Court, the Commission concludes that Standard Oil domination has had a "fundamental bearing" upon gasoline prices, declared to have been arbitrarily increased.

In an exhaustive report of its investigation, under resolutions of Senators Gore and Owen of Oklahoma and its statutory authority, the Commission declares, in substance, that real competition does not exist between the various Standard Oil companies because of interlocking stock ownership through the holding of a majority of shares in the constituent Standard companies by identical interests.

Legislation to meet these conditions is recommended by the Commission. Also its evidence and findings have been transmitted to the Attorney General for appropriate action.

### Findings of Commission

The principal findings of the Commission are:

*That in a majority of marketing territories the Standard companies are dominant*

*That the several Standard companies have maintained a distribution of territory in the marketing of gasoline, and that no substantial competition in the chief petroleum products exists among the several Standard companies.*

*That this absence of competition is due to a community of stock ownership.*

(*Continued on page* 817)

# War Dept. Accepts Co-operation

## Recommends Volunteer Motor Transport Companies—Probably No Call for Service

NEW YORK, April 20 — The Government has accepted the offers of co-operation by the automobile industry and recommends the immediate formation of as many voluntary motor truck, passenger car, and motorcycle companies as possible in all states and particularly along the Atlantic, Gulf and Pacific Coasts, as a measure of preparedness. It is thought, however, that there will not be any call for these vehicles for regular army service.

The task of directing this work has been delegated to the Volunteer Motor Transport Committee, consisting of Alfred Reeves, National Automobile Chamber of Commerce, as Chairman; A. G. Batchelder, American Automobile Assn.; Coker F. Clarkson, Society of Automobile Engineers; Edward H. Broadwell, Motor and Accessory Manufacturers; Roderick Stephens, Motor Truck Club of America, and Shelby A. Falor, Federation of American Motorcyclists. This committee will operate under the Advisory Commission of the Council of National Defense.

The committee will co-operate also in the recruiting of competent drivers and mechanics for the Enlisted Reserve Corps of the Quartermaster's Department of the Army under the direction of General H. S. Sharpe and Colonel Chauncey B. Baker of the Quartermaster's Corps, at Washington.

Its work will be to organize volunteer motor companies in all states, and especially in cities near the seacoast. The committee will also obtain particulars of the roads for military purposes, especially with regard to their ability to carry heavy motor traffic.

Volunteer companies will include the necessary officers, drivers and mechanics and will be used, when occasion requires, for quickly moving bodies of troops or supplies to particular points. Such service probably will extend over only a day or two at a time, but many of the men may later wish to enlist for military service during the war. Col. Baker says that cars or trucks of citizen owners will not be required by the Army, as the Quartermaster's Office will be able to buy new equipment as fast as the new and bigger Army is organized.

A volunteer motor transport reserve company, of which hundreds will be organized, will consist, in the case of trucks, of the following: A captain, who will have general supervision over the organization; one truck master, three assistant truck masters, one mechanic, two helpers, two cooks, one watchman and thirty-three chauffeurs. These men will bear titles from Sergeant First Class to corporals and privates, and will have charge of an equipment of twenty-seven cargo trucks, preferably of the 1½ and 3-ton sizes, one repair and kitchen truck, two oil and gasoline supply trucks and one automobile and one light repair truck. The personnel may be increased by adding assistant chauffeurs and cooks when needed.

Automobile and motorcycle companies will be organized along very similar lines, this form of organization and the regulations governing it being the same for volunteer companies as for motor companies in the regular army at present. Three motor companies will constitute a battalion, with a Major in command. For truck companies the preference is for 1½ and 3-ton trucks, although other types may be enlisted All types of passenger cars may be included.

Headquarters of the Volunteer Motor Transport Committee are at 7 East 42d Street.

## *U. S. Business Publishers*

### Crystallize Their Co-operation

A RESOLUTION

*WHEREAS, There has been ably presented at this meeting of the New York Business Publishers by Mr. Charles H. Sherrill and Mr. Glenn Frank the activities of the Council of National Defense and its advisory departments, and*

*WHEREAS, The different members of the New York Business Publishers, together with more than a hundred publishers in other cities of the country, have definitely pledged themselves to co-operate with the Government and give free advertising space during the period of the war, and*

*WHEREAS, The business papers of this country recognize their responsibility as well as their influence in backing up the activities of the Government in commercial preparedness, as well as the sale of bonds and recruiting; therefore be it*

*RESOLVED, That the New York Business Publishers, through the organization of the Editorial Conference, co-operate with all the branches of the Government with the purpose of obtaining the enthusiastic support of all the subscribers of the business papers who are individuals and corporations of importance in this country, and that said Editorial Conference should put out weekly bulletins to all the business papers who are members of this organization and all other business papers, giving the results of its investigation and co-operation, and be it*

*FURTHER RESOLVED, That we invite all the different branches of the Council of National Defense and its advisory boards to send to the New York Business Publishers all bulletins and requests for co-operation which will enable us to carry out the spirit of these resolutions.*

# Publishers Back Army Bill

## Indorse President Wilson's Plan for Universal Military Service in Resolution

NEW YORK, April 24—The New York Business Publishers' Assn. last night voted approval of universal military service and pledged its support to the Government at its monthly dinner meeting at the Automobile Club of America. Howard E. Coffin, of the Council of National Defense, who was scheduled to speak, unfortunately could not attend.

Colonel Charles H. Sherrill, former Minister to Argentina, and Glenn Frank, assistant to the president of the Filene organization in Boston, were the principal speakers. With the approval of the 200 present, Colonel Sherrill sent telegrams to the Senators from New York and to Congressman Kahn of California in support of the Administration's army bill, stating that the trade journals represented were emphatically in favor of universal service.

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### Railroads Obtain 15 Per Cent Freight Rate Advance

WASHINGTON, April 20—The railroads of the country have been granted the 15 per cent increase in rates, effective June 1. Though the order given by the Interstate Commerce Commission is tentative, subject to recall, it is thought that the increase will go through on that date. The automobile makers, it is stated, will not oppose the increase, because it is understood that the raise is imperative if the roads are to continue to operate profitably.

The effect upon the automobile industry will be the expenditure of additional millions of dollars, much of which will ultimately be borne by the buyer. While much of the parts and accessories is shipped by express, the increase in rates will have a more direct effect upon the jobber and the dealer because it has not been the custom in the accessories field to add freight with the advertised retail price, this being absorbed by the maker, jobber and dealer as part of the overhead expense.

### Adds $18 Per Carload

Automobile shipments, in standard carloads, will be increased on an average a little over $18 a carload. This covers shipments from Detroit and other Central West cities to various shipping points. All the rates are for 36-ft. cars with the exception of those to coast points, which cover 36 to 40-ft. cars. The appended table gives a comparison.

| Distances | Old | Increase | New |
|---|---|---|---|
| Toledo and Detroit to New York | $67.70 | $10.15 | $77.85 |
| Cleveland to New York. | 61.50 | 9.23 | 70.73 |
| Lansing to New York... | 82.40 | 12.36 | 94.76 |
| Flint to New York..... | 79.80 | 11.97 | 91.77 |
| Detroit to all coast p'nts | 310.00 | 46.50 | 356.50 |
| Detroit to New Orleans. | 142.40 | 21.36 | 163.76 |
| Indianapolis to New York | 80.60 | 12.09 | 92.69 |
| Detroit to Atlanta..... | 151.40 | 22.71 | 174.11 |

# S. A. E. to Meet on June 25-26

## Change from 1-Day Session Follows Conference Arranging for Closer Co-operation

WASHINGTON, D. C., April 25—The summer meeting of the Society of Automobile Engineers scheduled to be held in this city on Monday, June 25, will be a 2-day session, instead of a 1-day session as previously announced. Monday, June 25, and Tuesday, June 26, will be devoted to the work. Sessions will be held in the Auditorium of the Bureau of Standards, which is some distance out from the center of the city. This change in arrangements followed a 2-day conference of several of the members of the council of the society who have been here for 2 days arranging for the summer meeting and also taking up matters of closer co-operation of the society with the government.

**Standards Meeting June 25**

A definite program for the 2-day meeting has not been exactly determined upon, but a rough draft shows that the work of Monday, June 25, will be entirely given over to the standards committee, which will meet at 10 a. m. at the Bureau of Standards and continue in session for the remainder of the day.

The evening will be given over to examination of the equipment of the Bureau of Standards and perhaps some special demonstrations arranged for the engineers.

**General Meeting June 26**

Tuesday, June 26, will be for the entire membership of the society, the program consisting of a business meeting with president's address and various reports in the forenoon, followed by a professional session in the afternoon, and an informal dinner in the evening. The afternoon session will have approximately three or four papers of a practical nature dealing largely with the work of the different activities of the society in relation to the government. It is hoped that one of the foreign aviation engineers will present a paper on this subject. Similar practical papers will be presented on submarines or submarine chasers, automotive apparatus for field artillery, and the part of the farm tractor in the food problem.

No attempt will be made to arrange hotel reservations for members attending. They will have to arrange in advance at the various Washington hotels for accommodations.

Many members of the society are making headquarters in Washington at present and the New Willard Hotel here recalls a New York hotel at show week, so many of the automobile, airplane, and tractor people are on hand. Closely associated with government co-operation are many members of the S. A. E. W. H. Van Dervoort, past-president, has a permanent office in the Munsey Building in connection with his work on standardization of munitions; S. D. Waldon, formerly of Packard and Cadillac, has an office in the same building and is working on matters of aeroplane organization and problems connected with increased production; K. W. Zimmerschied, former chairman of the Standards Committee, is lending aid in a general way and expects to make headquarters here for some time; Charles B. King, one of the pioneers in the automobile industry, has been working with the government for many months; Henry Souther, former president of the S. A. E., has been connected with the aeroplane department in an engineering capacity for nearly a year. Howard E. Coffin, also past-president of the society, has been giving all of his time to defense work for practically a year, and is the leading representative of the automotive industry in Washington. President George W. Dunham, of the S. A. E., has recently been given an appointment on the bureau for the development of motor apparatus for moving field artillery. Roderick W. Stephens, president of the Motor Truck Club of America, is devoting all of his time to recruiting truck drivers. He has established committees for this work in New York, Boston, and Philadelphia and is at present in Atlanta, Ga., arranging similar committees. George H. Duck, for years connected with the automobile industry, is working at Governors Island, N. Y., examining motor truck drivers. Each week brings new S. A. E. members to the front in this government activity work.

The S. A. E. committee on tractor preparedness, consisting of H. L. Horning, Waukesha Motor Co., Frederick Glover, Emerson-Brantingham Co. and David Beecroft, THE AUTOMOBILE, have been in session here for 2 days drafting plans to submit to the Council of National Defense for increased efficiency of tractors at present in use and for greatly increased production during the present and coming years.

GEORGE W. DUNHAM

*President of the Society of Automotive Engineers, who has been appointed a member of the Tractor Board of the Ordnance Department*

# Dunham on Tractor Board

## S. A. E. President Appointed to Body in Charge of Tractor Applications in War

WASHINGTON, D. C., April 25—George W. Dunham, president of the Society of Automotive Engineers, has been appointed a member of the Tractor Board of the Ordnance Department. This board will have to do with the application of different tractor types of apparatus to the movement of large guns such as howitzers and various other types. The remainder of the board will largely be composed of army men.

Mr. Dunham has been connected with the automobile industry since 1901. He has been chief engineer of the Olds Motor Works, of the Hudson Motor Car Co., and vice-president of the Chalmers Motor Car Co. Mr. Dunham now has consulting offices in Detroit. He was born May 4, 1876, and received his engineering education in machine shops.

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**137 S. A. E. Memberships Approved**

NEW YORK, April 23—As a result of the membership drive of the Society of Automobile Engineers last week the total has been driven up to 2399, as compared with 2262 the previous week, a net gain of 137.

—

**M. & A. M. Favors Conscription and Universal Tax**

NEW YORK, April 21—Automobile accessory manufacturers are overwhelmingly in favor of conscription, according to returns from three bulletins sent out by the Motor and Accessory Manufacturers last week. At that time the makers were also asked their sentiment in regard to the telegram sent to Howard E. Coffin, of the National Defense Committee at Washington, in which he was told that the accessory association had formed a committee, headed by C. W. Stiger, to mobilize the resources, both material and men, for co-operating with the Government. As a result of this telegram the question naturally arose as to whether these companies were willing to make preferential delivery at reasonable prices on all the products demanded by the Government. According to the votes returned, the makers are about 90 per cent in favor of the plan.

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**England Lifts Tractor Prohibition**

LONDON, April 20—The prohibition of the importation of agricultural tractors has been suspended for the present.

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**Fremont Gets Tractor Demonstration**

FREMONT, NEB., April 26—The Tractor Demonstration Committee of the National Assn. of Tractor and Thresher Manufacturers has awarded the only official tractor demonstration for 1917 to Fremont. Dates are Aug. 6 to 10, inclusive. A. E. Hildebrand will be manager.

# Hudson Racers Are Now Ready

## Designed for Stock Events — Differ Little from Super-Six —115 H. P. Engines

DETROIT, April 25—The five Hudson racing cars are now ready. In making its program for 1916 Hudson did not consider any speed events except those for stock cars, because it did not believe then that successful racing cars could be built without departing so radically from stock car structure that the racer performance would signify nothing of what could be expected in a standard car.

The bore of the five racing specials is 3.50 in.; stroke 5 in.; 288.9 cu. in. displacement. They develop 115 hp. and can sustain this speed for hours. In fact they are commercially practicable modifications of a stock product rather than racing engines in the accepted sense of the term. The crankcase and cylinder block design is standard. The latter is equipped to take two carbureters on the same manifold. The crankshaft is the standard patented Super-Six design. All other parts are of standard materials except the pistons, which are Magnalite, instead of cast iron. By reducing the weight of the standard parts through dispensing with surplus metal and decreasing certain sections, it is the hope of the Hudson engineering department to gain information which may be of use in further developing and improving the standard design. For instance, it would be impossible to accurately develop improvements in heat treatment which would be of benefit to the stock product if any important change were made in standard design.

### Timing Is Standard

Even the timing of the racing specials is standard. The valve areas have been increased from 1 13/16 to 1 55/64 by boring out the valve port and substituting a valve with a larger head. The lift is slightly increased. Lighter valve tappets have been obtained by omitting the adjustment and making them hollow.

The standard valve springs have been compressed to make them stronger and thus insure greater accuracy of action at high speeds. Timing gears are standard, but the camshaft is changed to give the increased valve lift. Standard material is used in the connecting-rod assembly and the wristpin, but they have been reduced to secure the least weight.

The racing engines are fitted with an auxiliary high pressure oiling system operated from the camshaft. This is a rotary or gear pump, designed to circulate the heavy castor oil used for high speed work. The oil is pumped through a cooler to the four main bearings and from there direct to the connecting-rod bearings. The object of this pump is to drive a sufficient quantity of cool oil through the connecting-rod bearings to carry off the heat generated by the development of great excess power.

As in the building of the Super-Six racing engine the same policy of development by racing has been followed throughout the design of the specials. The frame is a standard touring car frame in all respects except that it has been shortened, drilled and cut away to make it lighter. The axles are the same, the springs are the same. They have been reduced in weight only by paring down the standard product. The transmission, the propeller shaft, universal clutch, pedal control and all minor details are of regular Hudson stock materials. The radiator is standard but is inclosed in a special shell designed with the sole idea of lightness and minimum wind resistance. The same applies to the body, which weighs about 85 lb. complete with tail, floorboards and bonnet.

Cooling louvres in the bonnet at the body dash are designed to permit the maximum circulation of air through the hood and carry away the heat of the exhaust manifold. The complete car will weigh approximately 2100 lb. empty. The maximum gasoline to be carried is 50 gal.; oil, 11 gal. There are two gasoline tanks and two oil reservoirs, the latter separated to afford the best cooling facilities.

Except for the cost of building the special body the racing special has been produced from the standard Super-Six at a moderate extra cost. As a quantity production car it could be made at a cost slightly in excess of the Hudson Super-Six.

Ralph Mulford and Ira Vail will hold the first wheels for the Hudson, with Bill Chandler, Ralph Kriplen and Jack Gable as reserve drivers. Billy Chandler will have charge of the mechanics and rule the pit. Arthur J. Hill, formerly manager of Dario Resta, will manage the team.

All of the prize money that the team wins will be divided among the men comprising it.

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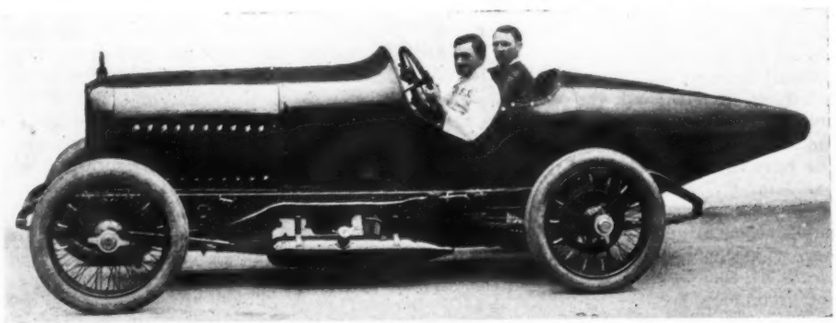
### Stutz Gives Chassis to Soldiers

INDIANAPOLIS, IND., April 23—The Stutz Motor Car Co. has distributed six specially constructed chassis to the Indiana National Guard.



*Here is the new Hudson Super-Six racing special for which many have looked with keen interest since the Hudson announcement that it would enter racers this year in all the big classics. The Hudson people asserted that the great power of the Super-Six motor was adapted to drive a racer at terrific speed, and therefore, except in the body design and a few changes in the chassis and motor, the Hudson racers are practically stock cars. There are five in the racing fleet; four are replicas of this and the other is somewhat similar also. Ralph Mulford and Ira Vail will be the Hudson's star drivers this year. Billy Chandler, who is shown at the wheel, and Jack Gable, in the mechanic's seat, will be the reserve drivers*

# Electric Vehicle Boom Planned

## Manufacturers Adopt Recommendations for National Educational Campaign

NEW YORK, April 20—Electric car and truck manufacturers took the first step in securing definite concerted action by the entire industry on a National Educational Campaign at a meeting held here yesterday. They adopted, for recommendation to the Council of the National Light Assn., the concrete proposal made by E. P. Chalfant, manager of the eastern division of the Anderson Electric Car Co. This proposal for giving new life to the electric vehicle industry is as follows:

1—All divisions of the industry to raise a fund to engage an experienced man to take charge of the propaganda, working under electric vehicle makers. Yearly cost, about $20,000, manufacturers to pay $1,000 a year each, and balance of 25 per cent to be supplied by central stations through N. E. L. A.

2—A booklet to be prepared for distribution to the central stations, setting forth the history, potentialities, and possibilities of the electric vehicle business, and explaining to the central stations how they can co-operate through advertising and spreading information.

a Methods employed and suggested for use by the central stations.
b How a man employed by a central station might co-operate.
c Specimen advertisements advertising the industry and not any particular car.
d Complete information regarding electric apparatus and its operation and sale.
e How central stations can co-operate with dealers and garagemen.
f How boosting stations may be installed.
g Why central stations should have an electric vehicle department.
h Information to central stations as to what has been done in large cities regarding parking facilities.
i How a booklet can be prepared for distribution to car owners, showing the location of garages and charging stations in the city and surrounding country.
j Battery exchange methods now successfully used and how they operate.
k Recommendations that central stations assist garagemen in getting together to establish uniform methods.

3—Central stations to be made familiar with the value of electric vehicle charging as an off-peak, long-hour, low-demand department of their business with a possible view to rate revision.

Besides the electric car and truck makers, manufacturers of industrial trucks, batteries, tires and accessories were represented at the meeting. A paper by G. D. Fairgrieve, vice-president of the Anderson Electric Car Co., on advertising and publicity advocated inducing central stations to co-operate with electric vehicle manufacturers in advertising current for vehicle use just as gasoline and oil companies advertise their products for gasoline car consumption. Developing this thing somewhat further, E. P. Chalfant read a paper on What Co-operation Means, covering financial, physical and educational phases of the subject. C. A. Street, Walker Vehicle Co., stated that the charging problem in electric vehicle selling is a small one, as he has always found central stations ready to install charging apparatus in garages on request. Chairman Mansfield pointed to the rapid increase in the ultilization of electric industrial trucks and predicted realization of much greater opportunities in this field in the future. Electric vehicle manufacturers get best results in distribution by selling through dealers, according to the paper on Distribution by P. D. Wagoner, president General Vehicle Co. Mr. Wagoner approached the distribution and sales problems of the electric vehicle manufacturer, with special reference to commercial vehicles, from every angle. A digest of his paper will appear in the Manufacturers' Merchandising Department in an early issue of THE AUTOMOBILE.

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## Changes in Prices

| Car and Model | Former Price | Present Price | Effective |
|---|---|---|---|
| Metz, 2-Pas..... | $600 | $650 | May 1 |
| Metz, 5-Pas..... | 600 | 650 | May 1 |
| Empire, 70, 7-Pas.... | 1,265 | 1,315 | May 1 |
| Empire 70, 5-Pas.... | 1,255 | 1,285 | May 1 |
| Princess, 5-Pas. Tour. | 775 | 825 | May 1 |
| Princess, 3-Pas. Rdst. | 775 | 825 | May 1 |
| Princess, 4-Pas. Club. | 775 | 825 | May 1 |
| Monroe, M-4 Touring | 985 | 1,095 | Apr. 13 |
| Monroe, M-5 Club... | 985 | 1,095 | Apr. 13 |
| Ross, 4-Pas. Touring. | 1,550 | 1,750 | Apr. 20 |
| Ross, 7-Pas. Touring. | 1,550 | 1,750 | Apr. 20 |

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### Metz Raises Prices—Electric Equipment

WALTHAM, MASS., April 20—The two-passenger roadster and the five-passenger touring car models of the Metz Co. will be raised in price from $600 to $650 on May 1. These models will be equipped with Westinghouse starter and lighting, together with Atwater Kent ignition.

—

### Westcott Prices Higher May 1

NEW YORK, April 23—The Westcott Motor Car Co. will increase the prices of its four-passenger roadster and the five-passenger touring car on May 1 from $1,590 to $1,790, and these will be fitted with 35 by 4½ tires instead of 34 by 4 now used. Omission of the words "roadster and the five-passenger" in THE AUTOMOBILE for April 12 made this read "four-passenger touring car."

# Entz Transmission Described

## Metropolitan Section S. A. E. Hears Paper by W. S. Goll of General Electric Co.

NEW YORK, April 20—The Metropolitan Section of the Society of Automotive Engineers was last night to have heard two papers on gas electric systems, one from Walter S. Goll, of the Fort Wayne branch of the General Electric Co., where the Owen-Entz transmissions are made for the magnetic car, and the other from W. P. Kennedy on the Woods electric. Unfortunately, the latter of these two papers was not forthcoming, but Mr. Goll gave one of the best addresses descriptive of the Owen system which has ever been written. It was illustrated with lantern slides made from diagrams of which the majority have been published from time to time in THE AUTOMOBILE.

While technical, the paper was not highly technical, that is to say, it did not go into such matters as efficiency figures. It was essentially an explanation of the system written for a man with some knowledge of electricity and a good knowledge of automobile mechanics.

The author first pointed out the factors which made steam power nearer the ideal for automobile operation than gas power, and he then went on to show how the Owen magnetic transmission gave to the rear wheel drive all the desirable attributes of steam and possibly some others as well.

At the conclusion of the paper a series of motion pictures was shown, which demonstrated very clearly the special virtues of the magnetic transmission. They showed the car climbing a stiff grade at a very low speed; how it could be allowed to run backwards and then be stopped and moved forward again slowly by closing and opening the throttle. Another series showed the wheel climbing over a large rock, and it was noticeable that the action was so smooth and general that practically no bounds occurred, although the stones in question must have been at least a foot high.

In opening the discussion, Mr. Potter, of the Chicago, Milwaukee & St. Paul Railroad, spoke on the advantages of electric power in railroad work. He said that the operation of railroads in mountainous country had been completely revolutionized by the electric locomotive. Two particular advantages were to be noted. First, the electric engine operates more efficiently when it is well cooled, which means that its power increases in winter and decreases in summer, exactly the reverse of what happens with steam locomotives. At the same time, the rolling resistance of a train is greater in winter than in summer. With steam power the weight of the trains must be cut down in winter, but with the electric power a balance is struck automatically, which enables the same size of train to be operated winter and summer. Pictures of a gas electric passenger car were shown, this being a 70-ft. steel car of regulation type equipped with a large eight-cylinder engine generating electricity which is taken to motors on the two bogies.

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### U. S. Will Need 4000 Aviators in Next Year

DETROIT, April 23—William D. Stout, airplane engineer of the Packard Motor Car Co., stated that more than 4000 aviators will be required by the Government within the next year in an address before the Detroit Engineering Society Saturday night. Mr. Stout pointed out that Detroit was the logical training ground for aviation. Other speakers were J. H. Poole, C. E. Drayer, secretary of the Cleveland Engineering Society; Alderman Fenkeell and A. A. Templeton. More than 700 members attended. The following officers were elected: William Putnam, president; L. R. Hoffman, first vice-president; Clarence W. Hubbell, second vice-president, and D. V. Williamson, secretary-treasurer.

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### Automotive Electric Accessories Formed

ATLANTIC CITY, N. J., April 21—An organization of manufacturers of automotive electric accessories was recently formed here. This new organization will be known as the Automotive Electric Association. Among its members are some of the largest manufacturers in this line. The purposes of the organization are to improve and develop this branch of the automotive electric accessories business through standardization and by friendly interchange of experience with reference to design and manufacture.

The following officers were elected at this meeting: G. Brewer Griffin, president, Pittsburgh, Pa.; C. O. Mininger, vice-president, Toledo; G. S. Cole, secretary, Cleveland, and C. L. Amos, treasurer, Syracuse, N. Y.

The next meeting of this association will be held at Hot Springs, Va., May 17, 18 and 19.

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### 6200 Pierce-Arrow Employees Join Red Cross

BUFFALO, N. Y., April 24—Employees and officials of the Pierce-Arrow Co., numbering 6200, last week joined the American Red Cross. The soliciting of members, which added $6,600 to the Red Cross fund, was under the general direction of Henry May, vice-president of the company and a general committee under which were sub-committees that canvassed the various departments.

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### Women for Detroit Factories

DETROIT, April 24—The Executive Club of the Detroit Board of Commerce has taken steps to enroll 12,000 women for industrial work to replace men called to the front.

# Factory Developments

CHICAGO, April 20—The Maxfer Truck & Tractor Co. has outgrown its present quarters here and is moving to Harvey, Ill. It will take occupancy of the former plant of the Packless Valve Co., which will be equal to double the capacity of its present plant, and in addition will have better railroad facilities, since this new plant is adjacent to the Baltimore & Ohio and Belt Line railroads.

C. R. Strong, formerly production manager for the Ford Motor Co. at Chicago, has joined the Maxfer company as production manager.

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SAGINAW, MICH., April 23—The meeting in Saginaw of W. C. Durant and associates held last week, as announced in an earlier issue of THE AUTOMOBILE, will result in the opening of the large factory building formerly occupied by the Marquette Motor Works. This information is based upon a positive statement made by Mayor H. T. Paddock of Saginaw.

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ALMA, MICH., April 24—The plant of the Western Carburetor Co. has been completed. The company is starting manufacturing with 6 months' orders on its books.

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CLEVELAND, April 21 — The Grant Motor Corp. has purchased additional land adjoining its present new plant and will build several buildings at a cost of $500,000. One building will be 647 ft. by 160 ft. and another 400 ft. by 160 ft. In addition, there will be a new office building 40 ft. by 160 ft.

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INDIANAPOLIS, April 23—The Haynes Automobile Co. last week purchased a farm of 58.85 acres west of Kokomo to be used as the site for the new plant, plans for which recently were announced. A site of 38 acres purchased some time ago has been abandoned for manufacturing purposes, as it was believed more ground should be available for development. The factory will be 1160 ft. by 560 ft., and will have 649,000 sq. ft. of floor space.

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DETROIT, April 24—The American Motor Truck Co. has purchased a factory plant which it is converting for truck manufacture and has commenced the installation of machinery and material. The company claims it will have twenty-four trucks under construction by May 15. The new factory is a one story brick structure with 40,000 sq. ft. of floor space. The truck is made of standard materials, including Continental engine, and is manufactured in 2, 3½ and 5-ton models, all of which sell for more than $3,000 each.

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NAPOLEON, April 21—The Napoleon Crown Fender Co., capital $20,000, has been sold to C. D. Peifer of Fostoria, Ohio. It will remain here and its entire output will be taken by the Allen Motor Car Co., Fostoria.

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LANSING, MICH., April 24—The Duplex Truck Co. will erect a factory here 72 by 608 ft., two stories high with a basement.

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COLUMBUS, OHIO, April 20—Peters & Harron Dash Co., which manufactures Invincible seat covers, tire covers, etc., is building a one-story factory addition, 65 by 100, which will double the size of its plant.

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LANCASTER, OHIO, April 21—The Oberlin Auto Truck Mfg. Co. has purchased the building here formerly occupied by the Kyle Mfg. Co. The new concern will be capitalized at $1,200,000, of which $750,000 will be common and $500,000 preferred. About 250 men will be employed.

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CANTON, OHIO, April 20—The Timken Roller Bearing Co. has established a department which will furnish bearings for application to farm tractors. L. M. Klinedinst is manager of the department. There has been a demand for bearings in this field for some time, but because of the regular demand in the automobile field the company was unable to specialize until it recently made factory additions, including a cold drawn steel tube mill and a steel mill.

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WAUKESHA, WIS., April 21—Due to the ever-increasing demands of industries at Waukesha, consisting mainly of concerns allied with the car and truck field, for more workmen, heads of several large companies have organized the Manufacturers' Building Co., with $100,000 capital, to finance the construction of about 100 dwellings. These will be leased to workmen at a fair rental or sold approximately at cost.

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MANITOWOC, WIS., April 21 — The Aluminum Castings Co., with headquarters at Cleveland, and operating seven large foundries in the United States, has disposed of its present plant at Manitowoc to the Aluminum Goods Mfg. Co., Manitowoc, Two Rivers, Wis., and Newark, N. J., and on May 1 will start construction work on a new plant on a new site in Manitowoc. It will involve an expenditure of more than $250,000 and be practically a duplicate of the new foundry just completed at Cleveland. The main shop will be 200 by 300 ft. and is to be ready about Sept. 1, on which date the Aluminum Goods Mfg. Co. will take possession of the present works and triple its own facilities.

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CLEVELAND, April 23—Executive offices of The Standard Parts Co. were opened the past week in the Hickox Building. Only the central organization will be in this location. The forces in charge at the several factories, embracing the plants of the former Perfection Spring Co., Standard Welding Co., Western Spring & Axle Co., and Bock Bearing Co., are not directly affected by the opening of these headquarters and will for the most part remain without change. Its twelve factories employ 8000 people and a working capital of about $22,000,000.

Besides President Christian Girl, there will be at the executive headquarters the offices of Dan C. Swander, general sales director; J. G. Utz, director of engineering; Horace H. Newsom, director of purchases; J. H. Liston, manager of jobbing department; E. R. Finkenstaedt, assistant to the president, and James A. Braden, special publicity.

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CINCINNATI, April 23—The United States Motor Truck Co. has rearranged its plant and shop schedule. The machine shop department has had its capacity tripled, and is running night and day.

The company has opened export offices in New York at 1457 Broadway. C. W. Moody is in charge.

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DETROIT, April 23—The Springer Wire Wheel Co. will start manufacturing in its new plant within 30 days.

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CLEVELAND, OHIO, April 23—The G. Mitchell & Son Co., Cleveland, will erect a factory costing $250,000 for the manufacture of automobile sheet metal parts.

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BUCHANAN, MICH., April 23—The Clark Equipment Co. has started the erection of a new wheel shop, which will increase its present wheel capacity approximately 50 per cent. This new building will be 180 by 60 ft. When finished it will be able to produce approximately 100 finished steel and truck wheels daily.

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SOUTH BEND, IND., April 23—The Noble Motor Truck Co., Kendallville, will produce its first truck in about three weeks.

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MILWAUKEE, WIS., April 21—The Roberts Brass Co., 249 Lake Street, Milwaukee, automobile specialties, has completed plans for the erection of a complete new manufacturing plant, to be located on Lincoln Avenue, near Alexander Street. The first building will be of fireproof construction, 50 by 100 ft. in size.

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SAGINAW, MICH., April 24—The Studebaker Corp. of America will erect a large assembling plant at Saginaw and will employ 700 men here. This plant will be established in an effort to overcome transportation difficulties arising from freight car shortage.

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DETROIT, April 24—The J. C. Wilson Co. has completely remodeled the executive offices and the assembly floors of

its motor truck plant. The expansion was necessitated by the addition of 1-ton and 3½-ton models.

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CLEVELAND, April 23—The Disbrow Motors Corp. has moved to its new factory in this city and will engage in the production of the Disbrow semi-racing sport cars on a larger scale. The production schedule for this year calls for 2500 cars.

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PONTIAC, MICH., April 23—The Olympian Motors Co. is installed in its new factory and is now maintaining a schedule of forty cars per day.

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AKRON, OHIO, April 24—Almost 1000 employees of the B. F. Goodrich Co. went on a strike yesterday demanding higher pay than $2.50 a day, according to a statement giv n out by the strike leaders. H. E. Joy, factory manager said only 200 men were out. He said there had only been a disagreement.

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### PRODUCTION

DETROIT, April 25—The Reo Motor Car Co., up to April 18, turned out 15,055 passenger cars and 4,566 trucks, compared with 13,557 passenger cars and 1566 trucks in the corresponding period in 1916. The gross sales of the current year to April 19 showed an increase of $2,440,730.34 or 15 per cent over the corresponding period last year.

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TOLEDO, April 19—The growth of the Willys-Overland Co. is shown by production figures recently issued which display that in 1911 the company was producing 14,749 cars more than it built in 1908. The gain in 1912 over 1911 was 11,568. Additional production growth in 1913 amounted to 7715 cars. The 1914 gain was 13,976, and the 1915 advance exceeded this by 45,251. Close to 100,000 cars were produced by the company in 1915. A still greater growth was recorded in 1916, when production figures reached the total of 142,807, a gain of 49,083 over the previous year. The production contracted for 1917 is 200,000 cars, a gain of more than 57,000.

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DETROIT, April 21—The Packard Motor Car Co. is preparing to increase its truck output from 600 trucks to 1000 trucks per month. The company will resume foreign shipments as soon as the Government requests that such aid be given the Allies. The company has made no foreign shipments since Dec. 15, 1916. Domestic business has gone forward rapidly and passed the $3,000,000 mark in March.

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NEW YORK, April 21—General Motors sales of finished cars and trucks for March amounted to 16,996 as against 13,824 a year ago.

For the 8 months of its fiscal year ended March 31 the company shipped and sold 112,529 cars and trucks, a gain of just under 28 per cent over the output of 86,881 for the first 8 months of 1915-16.

At the rate cars are now going forward this company will by the end of this month have disposed of practically as many cars as in the entire 1916 fiscal year, 132,088.

The Cadillac recorded a March output of 2032 cars.

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DETROIT, April 21—The Continental Motors Corp. is now approaching the production capacity of a motor a minute. Net earnings for the company for the past 4 years are reported as follows: Year ending June 30, 1913, $484,000; year ending June 30, 1914, $524,014; 1915, $1,222,128; year ending Oct. 31, 1916, $2,446,752.

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DETROIT, April 23—The Hupp Motor Car Corp. is 2000 cars behind its orders. This is despite the fact that the Hupp company has enjoyed the largest business in its history during the first quarter of this year.

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NEW YORK, April 20—The Chevrolet Motor Co. shipped 3090 cars during the week ending April 21, compared with 1260 in the same period in the preceding year.

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ALMA, MICH., April 24—The Republic Motor Truck Co. of this city is making extensions and improvements to enable the company to build 50,000 motor trucks in 1918. The company built 7000 trucks in 1916 and is turning out 23,000 this year.

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PONTIAC, MICH., April 21—Coincident with the announcement that the Olympian Motors Co. is installed in its new factory, President R. A. Palmer reports that a schedule of from thirty-five to forty Olympian cars a day is being maintained. The present plant, formerly occupied by the Cartercar company, has approximately 250,000 sq. ft. of floor space.

As the next step in the direction of expansion an additional building to be used for assembly, 800 by 300 ft. in size and one story in height, will be erected. The Olympian company owns the site for this structure, the acreage being alongside the present factory. The work of building this plant will be begun when the labor and material situations become favorable.

# News of Men in the Industry

DETROIT, April 21—Harry L. Bill has been appointed works manager of the Chalmers Motor Co. Mr. Bill was formerly the vice-president and general manager of the Springfield Body Corp., which position he resigned recently because of illness in his family. He was connected with the Chalmers company several years ago in the engineering and experimental departments and also as manager of the Chalmers racing teams of the early racing days.

In 1910 he became superintendent of production for the Chalmers company and 2 years later became general manager of the Everitt Motor Car Co., following this with the position of factory manager of the Disco Starter Co., general manager of the Hayes Mfg. Co., and then with the Springfield Body Corp.

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NEW YORK, April 26—M. J. Budlong has become general manager of Gaston, Williams & Wigmore. Mr. Budlong is now vice-president, as well as vice-president of the Gaston, Williams & Wigmore Steamship Corp. Prior to his connection with this exporting firm, Mr. Budlong was president of the Electric Vehicle Co., Hartford, president of the Packard Motor Car companies of New York, Philadelphia and Chicago, and assistant general manager of the Packard Motor Car Co. of Detroit.

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WASHINGTON, D. C., April 21—Tom O. Jones, former export and advertising manager of the Empire Automobile Co., Indianapolis, has been chosen to investigate the automobile markets in the Far East for the Bureau of Foreign and Domestic Commerce of the Department of Commerce.

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INDIANAPOLIS, April 21—W. E. Stalnaker, vice-president and director of sales of the Pathfinder Co., has tendered his services to H. B. Smith, adjutant-general, in recruiting an aero squadron of 168 officers and men.

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SOUTH BEND, IND., April 25—Harry Kerston has resigned from the Studebaker Corp. as designing engineer. He is associated with a company to make the Kerston gas-electric car.

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DETROIT, April 25—Bert Collins has resigned from the Parker Rust Proof Co. He was general sales manager.

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CLEVELAND, April 20—C. R. Armbrust has resigned from the Ben-Hur Motor Co., effective May 1. He was chief engineer and consulting engineer.

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DETROIT, April 26—George D. Wilcox, sales manager of the Commerce Motor Car Co. has joined the quartermaster's department of the U. S. Army as a captain.

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CINCINNATI, April 26—Charles J. Kloo, Jr., assistant sales manager of the United States Motor Truck Co., has joined the army.

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DETROIT, April 25—Horace C. Mills has been elected a director of the Stroh Casting Co. This company is expanding

rapidly, and employs 350 men on night and day shifts. Mr. Mills will be general sales manager. The company during the past 3 years has increased its daily output from 10 tons to 75 tons and produces enough transmissions daily to supply $1,000,000 of automobiles.

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DETROIT, April 25—H. B. Phipps, export manager of the Hudson Motor Car Co., will go to the Orient.

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DETROIT, April 23—J. D. Palmerlee has joined the Chalmers Motor Co. as district representative. He was formerly Southwestern district manager for the Hudson Motor Car Co.

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DETROIT, April 25—F. E. Henderson, special representative of the Hudson Motor Car Co., has taken a similar position with the Chalmers Motor Co.

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BUFFALO, N. Y., April 24—H. E. Partridge has resigned as manager of the Ford assembly plant here. G. B. Tyler succeeds him. Mr. Tyler was formerly manager of the Ford Sioux City, Iowa, assembly plant.

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EAST ORANGE, N. J., April 21—John McCann, purchasing agent of the Simms Magneto Co., is resigning May 1 to enter partnership with W. R. Keene, under the name of W. R. Keene & Co., New York, to manufacture taps, dies, drills, etc.

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NEW HAVEN, CONN., April 21—J. E. Nield has become purchasing agent of the Trego Motors Corp. He was formerly connected with the Knox Motors Co. in the same capacity.

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MOLINE, ILL., April 20—L. W. Nutt has joined the H. W. Cooper Saddlery Hardware Co. He was formerly secretary and purchasing agent of the Velie Motors Corp.

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DETROIT, April 21—Joe Dawson, winner of the most dramatic of all Indianapolis speedway races, the 500-mile contest in 1912, has joined the Chalmers Motor Co. as assistant experimental engineer with special duties in connection with the contest and trials section of the advertising department.

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DETROIT, April 24—V. S. Hibbard has become manager of sales and advertising of the Ross Automobile Co. He was formerly assistant sales manager of the Regal Motor Car Co.

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DETROIT, April 23—E. B. Koger, former sales engineer for the Master Carburetor Corp., has enlisted in the aviation corps of the United States Army.

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NEW YORK, April 23—John Fraser, consulting engineer, 30 Church Street, states that his office is and has been continuously in the Hudson Terminal Building since he first opened an engineering office in this city 9 years ago. He finds that confusion has arisen due to the announcement when he was recently elected a director in the Smith Motor Truck Corp., Chicago, that his office was at 52 William Street.

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PHILADELPHIA, PA., April 21—C. H. Roberts has been appointed comptroller of the Hess-Bright Manufacturing Co. He was formerly factory accountant.

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GERMANTOWN, PA., April 21—H. H. Jinnett has become credit manager of the Staybestos Mfg. Co., maker of friction facings, packings, etc. He was formerly with the Bell Telephone Co.

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ST. LOUIS, MO., April 23—Carl Hanson, former cost and production manager for the General Motors Co., has taken up his duties as cost and production expert for the Dorris Motor Car Co.

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LOS ANGELES, CAL., April 20—E. G. Sherman has secured the distributing rights for Sexton castor motor oil in California, Nevada and Arizona.

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CINCINNATI, April 23—F. A. Trinkle has become field service manager of the United States Motor Truck Co.

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CHICAGO, April 21—G. A. Gibson has been appointed production manager of the Diamond T Motor Car Co., maker of Diamond T trucks. Carl Burton will be in charge of material. Both men come from the Packard organization at Kansas City. J. B. Burris, formerly with the Packard company in New York, has also joined the company.

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KANSAS CITY, MO., April 21—B. J. MacMullen has resigned his position as manager of the Chalmers Motor Co. branch here.

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MANCHESTER, N. H., April 21—W. C. Goodchild has been placed at the head of the Metz business in this State, with headquarters here. He will have entire charge of the dealers.

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DETROIT, April 21—T. E. Dean, known as "Ted Dean," has resigned as district manager in the Southwest for the Hudson Motor Car Co.

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CLEVELAND, OHIO, April 20—James P. Hunting has been appointed manager of the Cleveland branch of the MacAvoy Advertising Co. of Chicago. Mr. Hunting was formerly treasurer of the Singleton-Hunting Co.

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DETROIT, April 20—Frank Shaw has joined the Harroun Motors Corp. staff as traffic manager. Mr. Shaw occupied a similar position with the Studebaker Corp. and the Maxwell Motor Co.

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MARSHALL, MICH., April 24—W. L. Page, E. E. Page and W. J. Dibble, directors of the All Season Body Co., have resigned. W. L. Page was the president of the company. The stock owned by these retiring directors was returned to the company and they have no further interest in it. Stockholders decided to defer the election of successors until a later date.

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### ELECTIONS

DETROIT, April 23—The Pronovost Torison Spring Wheel Co. has elected the following officers: Joseph Pronovost, president; N. E. Sherwood, vice-president; Floyd W. Warner, secretary-treasurer; A. H. Marsh and L. E. Weeks, consulting engineers.

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### Olds Interested in Tractor Demonstration

DETROIT, April 24—The Wolverine Tractor & Plow Co. will give a demonstration the latter part of this week on a farm owned by R. E. Olds, president of the Reo Motor Car Co., situated close to Detroit. Mr. Olds is evincing considerable interest in the Wolverine Tractor.

# N. Y. March Exports Gain 41%

## Shipments from That Port Total $6,258,549—England Big Truck Buyer

NEW YORK, April 24—Export trade from this country through this port in March increased nearly $2,000,000, the total being $6,258,549, as against $4,408,277 in February. Both truck and passenger car shipments were increased. Commercial vehicle exports numbered 789, valued at $2,311,344; passenger cars numbered 3148, valued at $2,278,090; and parts at $1,669,115. The shipments from New York during March nearly equalled those of February from all of the American shipping points, which totaled $6,897,086.

England was our biggest buyer in March, her truck purchases totaling 596, valued at $1,862,535. Her passenger car purchases were held down, probably on account of the restriction in imports as far as non-essential products are concerned. English passenger car shipments numbered only thirty-six, valued at $25,850. This compares with sixteen valued at $18,859.

Australia, British Indies, Spain, Chile and Argentina, in the order named, were our biggest buyers of automobiles, their purchases totaling about $1,000,000.

Germany does not appear on the list of our automobile and truck buyers during March, though she managed to receive in February two passenger cars valued at $2,315, and three trucks at $2,000 with $125 worth of parts.

The U. S. Government has taken up trading-with-the-enemy legislation. It is understood it follows closely British war trade measures, though much less stringent.

The bill prohibits trading with an alien resident in a country at war with the United States, but does not specifically prevent trading with the enemy aliens in neutral countries or in the United States.

# Oils Feature Market Activities

## Steel Output to Be Increased—Copper Lower in Price—Rubber Steady

NEW YORK, April 25—Oils and lubricants featured the local material market last week with large gains. Lard oil rose 5 cents a gallon; linseed 3 cents; and rapeseed oil 7 cents. Flaxseed was little higher at Duluth yesterday, but the extent of the improvement was not great enough to influence the linseed oil market. Crushers are not eager for orders, owing to the short supply they have on hand, but buyers are not taking anything more than is needed to cover immediate wants, and only the smaller consumers and distributers appear to be in the market at present.

The eastern crude oil output is showing some gain. The raise in the price of all eastern oils during the past week is expected to stimulate production quite a little. In nearly all of the districts gasoline plants have been installed and under construction. Market conditions affecting the refined products were much the same as for weeks past. Increasing demand, especially for gasoline, is the dominant feature of the situation. Gasoline has been raised 1 cent in Chicago, on the tank wagon basis, selling at 20 cents a gallon. Retailers are asking 23 cents. There is some speculation as to what effect the Federal Trade Commission report charging a monopoly of the petroleum trade may have on the course of prices for the various oil products. It is conjectured that it may cause to be deferred the advance which was considered to be a certainty when the effects of the usual increase in demand at this season began to be strongly felt.

The demand for steel has called for an increased output. The railroad orders for domestic and foreign account have taxed the production capacity of the steel mills. It is estimated that unless adverse conditions, now unforeseen, arise there will be produced close to 3,500,000 tons ingots, and the rolled sheet output is expected to aggregate close to 2,750,000 tons. A part of the tonnage, comprising 500,000 tons of steel rails for domestic railroad use which was offered last week, has been taken up by the mills.

The pressing need of Russia for railroad equipment has brought the United States Government to her assistance, and official efforts are being made to secure a heavy steel tonnage for export, which may take precedence of the demand for home consumption. Current orders for raw, finished and semi-finished material for the European belligerents are exceptionally heavy, and every effort is being made to rush them through.

The car shortage has added to the perplexity of the situation and to the accumulation to the steel freight at many points. According to authoritative statements, the net shortage of freight cars on April 1 was 143,059 cars, an increased shortage of 12,977 cars over March 1. With widespread demand for finished products, such as machinery and tool steel, there is apparently no holding back for reasons of price.

Copper has dropped in price. Electrolytic is now selling at 30 cents a pound, a drop of 1 cent. Lake copper has dropped 2¼ cents to 29. Buyers of copper are holding off on account of the uncertainty in the market. Nearby copper is scarce. There are no buyers for any position and the market may be quoted easy at prevailing quotations. Exports of copper during March were heavy, aggregating 45,324 tons, as against 26,231 tons in March, 1916.

Aluminum is in fair demand at 60 to 62 cents per pound. Sellers expect that the Government will soon be in the market for the metal.

Tin is selling at around $59 per 100 lb. The demand for tin following this sudden rise of nearly $3, has quite naturally fallen off. Tin has been singularly free from mishap during shipment. There has been no tin lost by U-boat activities to date, unless some losses have occurred so recently as to be unknown here.

Rubber prices are steady, plantation grades quoting at 1 to 2 cents higher. Ceylon first latex crepe is quoting at 82, a gain of 1½ cents. Para, on the other hand, has been inactive, quoting at 76. London advices show that the market for plantation has been dull. Arrivals have been fairly liberal. Rubber interests in New York state that there is plenty of rubber, caused by England allowing full shipments to come through.

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### $50 Pig Iron Predicted

DETROIT, April 23—Rumors in the pig iron and steel industry predict $50 iron in the near future.

### Chicago Materials Quotations for April 24

| | |
|---|---|
| Sheet steel, 21 gage, lb. | 9 cents |
| Cold rolled bar stock | 15% off list |
| Copper, lb. | 40 cents |
| Lead, lb | 95 cents |
| Aluminum, lb. | 60 cents |
| Tin, lb | 55 cents |
| Fuel oil, gal. | 4½ cents |
| Scrap iron, ton | $15-$30, depending on grade |
| Gasoline, gal. | 20 cents |
| Seamless steel tubing, 100 ft. | $10.80 |
| Linseed oil, gal | $1.15 |
| Antimony, lb | 35 cents |

# Tire Prices Point Upward

## Rise of from 10 to 15 Per Cent by May 1—Small Supply of Fabric

NEW YORK, April 23—Every indication points toward a further rise in the price of tires May 1. As yet no definite announcements have been made by tire makers though dealers in general are free in their prediction that prices are going up.

It is variously rumored that the increase will be as little as 10 per cent or as much as 25 per cent. Some dealers incline to the belief that probably 10 per cent will be added May 1 and another 10 per cent June 1.

As a matter of fact, rubber is a fairly staple article; there have been no great fluctuations in price for a year. The present price hovers around 80 cents, and while there have been no great stocks on hand during the past 2 years, rubber men do not view the situation with alarm. In brief there is plenty of rubber.

Cotton, on the other hand, has soared in price from 75 to 100 in the year. Last year the price of the best grades of Sea Island was about 60 cents; this year the figure is $1.50. The best of the Egyptian crop is now exhausted and the new crop will not come in until October. In the meantime tire makers are using more and more of American cotton, which has improved marvelously in quality of late. This is worth about 70 cents a pound now.

In so far as the supply of cotton for fabric is concerned, there is no uneasiness. But it is another matter to get that supply to this country. The British Government has commandeered ships for war purposes, and those ships that are left are in constant peril of submarines. One ship left Alexandria last week, but cotton brokers are not altogether enthusiastic about the possibility of it reaching New York.

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### Shipyards Buy Steel

DETROIT, April 23—Shipbuilding continues extraordinarily heavy demands for rolled steel products, plates, sheets,

### Daily Market Reports for the Past Week

| Material | Tues. | Wed. | Thurs. | Fri. | Sat. | Mon. | Week's Changes |
|---|---|---|---|---|---|---|---|
| Aluminum, lb. | .60 | .60 | .60 | .60 | .60 | .60 | ... |
| Antimony, lb. | .34 | .34 | .34 | .34 | .34 | .34 | ... |
| Bessemer Steel, ton | 75.00 | 75.00 | 75.00 | 75.00 | 75.00 | 75.00 | ... |
| Copper, Elec., lb. | .31 | .31 | .31 | .30 | .30 | .30 | — .01 |
| Copper, Lake, lb. | .31¼ | .31¼ | .31¼ | .29 | .29 | .29 | — .02¼ |
| Cottonseed Oil, bbl. | 15.25 | 15.35 | 15.50 | 15.00 | 15.00 | 15.20 | — .05 |
| Fish Oil, Menhaden, Brown, gal. | .75 | .75 | .75 | .75 | .75 | .75 | ... |
| Gasoline, Auto, bbl. | .24 | .24 | .24 | .24 | .24 | .24 | ... |
| Lard Oil, prime, gal. | 1.75 | 1.75 | 1.75 | 1.75 | 1.80 | 1.80 | + .05 |
| Lead, 100 lb. | 9.00 | 9.00 | 9.13 | 9.13 | 9.13 | 9.00 | ... |
| Linseed Oil, gal. | 1.17 | 1.17 | 1.20 | 1.20 | 1.20 | 1.20 | + .03 |
| Open-Hearth Steel, ton | 75.00 | 75.00 | 75.00 | 75.00 | 75.00 | 75.00 | ... |
| Petroleum, bbl., Kans., crude | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | ... |
| Petroleum, bbl., Pa., crude | 3.10 | 3.10 | 3.10 | 3.10 | 3.10 | 3.10 | ... |
| Rapeseed Oil, refined, gal. | 1.18 | 1.18 | 1.20 | 1.20 | 1.20 | 1.25 | + .07 |
| Rubber, Fine Up-River, Para, lb. | .76½ | .76½ | .76½ | .76½ | .76½ | .76 | — .00½ |
| Rubber, Ceylon, First Latex Crepe, lb. | .80½ | .80½ | .80½ | .82 | .82 | .82 | + .01½ |
| Sulphuric Acid, 60 Baume, gal. | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | ... |
| Tin, 100 lb. | 56.00 | 56.25 | 55.78 | 55.75 | 58.00 | 58.50 | +2.50 |
| Tire Scrap, lb. | .06½ | .06½ | .06½ | .06½ | .06½ | .06½ | ... |

tinplate and structural shapes. This is causing a reduction of the production of wire products which, as a consequence, has advanced $6 per ton.

Makers of tinplate have promised the Government to increase the output as much as possible so that there will be an ample supply of tin containers for the conservation of the food supply for the army and navy. This will necessitate large demands on the sheet mills.

Agricultural machinery manufacturers who are prepared to assist the Government campaign for intensified farming have increased their demands for soft steel bars and special steel. This demand now amounts to several hundred thousand tons.

Railroad equipment buying has been reduced to very small proportions, although domestic roads are ordering steel for rails for delivery in the last quarter of 1918 and the first quarter of 1919.

The Carnegie Steel Co. will furnish 18,000 tons of plates and shapes for torpedo boat destroyers for the United States Government.

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## Detroit Purchasing Agents to Form Organization

DETROIT, April 25—The organization meeting of the Detroit purchasing agents will be held to-morrow night, preceded by a supper. J. Edward Schipper, technical editor of THE AUTOMOBILE, has arranged the details.

Temporary officers will probably be elected and the organization completed. E. T. Wolfe and W. L. Chandler, of the National Purchasing Agents Assn., will address the meeting and will show the advantages of affiliating with the national organization.

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### Metal Assn. Pledges War Aid

NEW YORK, April 25—The National Metal Trades Assn. pledged support to President Wilson and assistance in mobilizing the country's resources, yesterday, at its nineteenth annual convention at the Hotel Astor. President W. H. Van Dervoort, past S. A. E. president, and president of the Moline Automobile Co., in his annual address pointed out that there had been 200 strikes in the metal trades in the last year, practically all due to the 8-hr. day. A large majority of those present seemed to feel that Government contracts should not carry the 8-hr. clause.

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### Saxon and King Higher May 1

DETROIT, April 24—The Saxon Motor Car Co. and the King Motor Car Co. will raise their prices May 1 $50 to $150 on all models.

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### Carl Page Negotiating for Detroiter

NEW YORK, April 25—Carl H. Page, handling the Jordan, has been in Detroit negotiating for adding the Detroiter to his line. He will move his salesrooms to 1895 Broadway.

# S R B Refinanced By Marlin

## Receivers Removed and Creditors All Paid—Germaine General Manager

PHILADELPHIA, April 20—Re-entry of the Standard Roller Bearing Co. into the manufacturing field on a larger scale of production with increased facilities and financial aid has been assured by the investment of approximately $500,000 by the Marlin Arms Corp., which recently bought the S. R. B. property. The company is now in a position to proceed with its plans, as the receivers have been removed and the creditors have all been paid. Though the Marlin company owns the stock of the company, it will be operated under its old name.

A new plant is under consideration, the location of which has not been decided upon. F. N. Germaine, who has been prominent in the activities of the company, remains as general manager. The organization remains approximately the same.

At the time of the sale of the S. R. B. property to the Marlin people, the Rockwell-Drake Corp., Fairfield, Conn., was also sold to the arms concern. The Rockwell-Drake Corp. manufactures machinery used in making ball and roller bearings. Thus this acquisition will be of especial value in pursuing the expansion plans that are in contemplation.

The manufacture of annular, thrust and double row ball bearings, and wire wheels and balls will be continued. Included in the policy of the new organization will be a service department. Bearings will be carried in stock and service stations will be established throughout the country to insure prompt deliveries. A branch office will be established in Detroit.

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### DIVIDENDS DECLARED

#### Russel Axle 100 Per Cent Stock Dividend

DETROIT, April 24—The Russel Motor Axle Co. will increase its authorized capital stock from $250,000 to $600,000 by increasing the common from $150,000 to $500,000. A common stock dividend of 100 per cent will be issued to stockholders of record May 1.

A large proportion of the amount subscribed of the company's authorized issue of $100,000 preferred stock has been redeemed and only $39,000 of the issue is now outstanding.

Approval of the stockholders was also given to the negotiations of the company's directors for the purchase of the gear plant of the Russel Wheel and Foundry Co. to assure the Russel Motor Axle Co. an adequate source of supply of differential and internal gears.

It is expected that the Russel Motor Axle Co. will expand to provide a 50 per cent increase in production.

Stockholders of the Russel Motor Axle Co. are nearly all stockholders of the Russel Wheel & Foundry Co. A. W. Russel, president of the former, is treasurer of the latter. W. S. Russel, president of the Russel Wheel & Foundry Co., is vice-president of the Russel Motor Axle Co. John R. Russel is secretary of the former company and George B. Russel is secretary and treasurer of the Russel Motor Axle Co.

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Stewart-Warner Speedometer Co., quarterly of 1½ per cent on common, payable May 15 to stock of April 30.

—

NEW YORK, April 23—The Guaranty Securities Corp., engaged in financing automobile purchases by time payments, has declared a dividend of 2 per cent, payable to stock of record April 14. The capital stock is $1,000,000.

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B. F. Goodrich Co., quarterly of $1 per share on common, payable Aug. 15 to stock of Aug. 3.

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## Rubber Interests Fight 20 Per Cent Duty

WASHINGTON, D. C., April 24—Representatives of the large rubber buying concerns are here to-day fighting the proposed 20 per cent import duty on all grades of rubber which the Government has introduced to raise revenue. The matter is now before the Ways and Means Committee and will be fought bitterly by the rubber interests on account of the big hardship it will put on all makers. Many of the rubber manufacturers have large contracts with the Government for rubber goods, based on the present prices, and if the duty should go through, it will practically wipe out all profits. This hardship together with the shortage of cotton duck, used in automobile tires, is bound to raise tire prices. The Government has placed large orders for cotton duck, or fabric, for use in its war preparation.

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### 58 Per Cent Increase in Maxwell Sales

NEW YORK, April 23—Sales of the Maxwell Motor Co. for the first 3 months of this year were more than 58 per cent larger than for the corresponding period last year. The total for the quarter was 19,000 cars against 12,032 cars in the first quarter of 1916. Indications are that after the usual dividends of $3,000,000 and a possible Government tax of between $500,000 and $600,000, almost $2,000,000 will be carried to surplus account.

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### Stromberg Sales $413,000 in Quarter

NEW YORK, April 26—Gross sales of Stromberg Carbureter Co. in the first quarter of 1917 were $413,000 an increase of 55 per cent over the corresponding period of 1916. Net profits this year were $89,500 an increase of 42 per cent over the March quarter of 1916.

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### Paige Business 65 Per Cent Greater

DETROIT, April 24—The Paige-Detroit Motor Car Co.'s business in March was 65 per cent greater than any month in its history. It is now obliged to turn down many trainload orders.

# Hayes Co. Earns $408,000

## On March 31 Assets Total $2,295,676—March Gross Sales Amount to $417,000

DETROIT, April 23—The Hayes Mfg. Co. earned $408,000 for the 9 months ending March 31. Earnings of the company in March were $60,180 on sales totaling $417,000 for the month.

The company's sheet shows total assets of $2,295,676.99 on March 31, this year, with surplus of $238,619.30 and reserve of $131,912.40 for depreciation. Current assets totaled $1,336,642.52 comprising $95,674.61 in cash, $469,592.60 in accounts receivable and $771,375.31 in inventories, of which $280,008.46 was the value of raw materials and $491,366.85 the value of goods in process of manufacture.

Current liabilities were $425,145.29, including $166,248.20 in notes payable, $191,449.82 in accounts payable and $67,447.27 in accrued pay-roll.

The company's net working capital, March 31, amounted to $911,497.33.

Fixed assets, including real estate, buildings and equipment, were appraised at $940,823.85 and other assets, including prepaid expenses, were given as $18,210.62.

Capital stock of the corporation comprises $1,500,000, the shares having par value of $10 and being all of one class.

—

### NEW COMPANIES

KIEL, WIS., April 21—Edward and Gottlieb Burkhardt, manufacturers of gas and steam engines, transmissions, motor car specialties, etc., have incorporated the business under the style of Kiel Machine Co., with an authorized capital of $15,000. The new concern intends to greatly enlarge its facilities.

—

ELKHORN, WIS., April 14—The Kant Kick Spark Set Co. has been organized by Will H. Opitz and Hugh Squires, who are the inventors and patentees of a number of Ford specialties, including a device which is said to make back-firing from advanced spark impossible by automatically retarding the timer. It is proposed to establish a factory in Elkhorn and make these and other devices on a large scale.

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LOS ANGELES, CAL., April 20—The California Vaporizer Co., capitalized at $50,000, has been formed here to market a heavy fuel outfit for Ford cars, which operates on gasoline, kerosene or distillate. The outfit will be manufactured on the Pacific Coast. The castings on the first lot of vaporizers are already coming through the foundry. The outfit consists of a vaporizer, carbureter and starting tank.

The device is distinct from other heavy fuel systems in that the fuel alone is heated after leaving the spray nozzle of the carbureter, where in other devices the mixture is heated as a whole.

The officers are: L. E. French, president and manager; S. B. Brown, vice-president and secretary, and C. E. Welch, treasurer.

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MILWAUKEE, April 23—The Dowse Rubber Co., capitalized at $2,500,000, has been formed by B. C. Dowse and associates. Mr. Dowse was formerly president and general manager of the Federal Rubber Mfg. Co. Negotiations have been practically completed for the purchase of two factories for making automobile and other pneumatic tires and mechanical goods. One of the plants will be at Chicago, which will be the home office of the new company. The capital is composed of $1,000 cumulative 7 per cent preferred and $1,500,000 common.

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COLUMBUS, OHIO, April 23—The Automatic Control Trailer Co. has been incorporated, with a preliminary capital of $25,000, to build trailers and equip all trailers with an automatic braking device, the patents of which are controlled by the company. Incorporators are: H. C. Rogers, John H. Price, S. A. Kinnear, C. W. Seaman and John G. Price. A plant has been fitted up at the Broad Oak Garage, which was recently purchased by H. C. Rogers. The device is an automatic brake, which is worked on all grades and thus saves trouble and dangers of the ordinary trailer. Daily demonstrations have been made at the plant.

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GREEN BAY, WIS., April 20—The Lawson Air Craft Co., Green Bay, Wis., is being organized with a capital stock of $50,000 by leading capitalists of that city under the direction of Alfred W. Lawson, Detroit, an aeroplane manufacturing expert and aviator, to establish a plant for the construction of flying machines. Some of the stockholders in the Lawson company are among those who recently organized the Oneida Motor Truck Co., with $300,000 capital.

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DALLAS, TEXAS, April 23—The Southwestern Tire & Rubber Mfg. Co. will establish a plant in this city, to cost $80,000. The company is capitalized at $250,000. Officers are: R. L. Cameron, president; W. W. Taxis and L. G. Murray, vice-presidents; W. E. Suttles, secretary, and J. G. Gillespie, treasurer.

—

GRAND RAPIDS, MICH., April 21—The Field Motor Co., capital $300,000, has taken the place of the old Field Motor Co., recently dissolved. The capital stock is divided into 50,000 shares, of which $250,000 has been subscribed. The stockholders are: Byron E. Parks, seventy-four shares; Adrian M. Noorthoek, 500 shares; J. Palmer McVean, 300 shares; Edward A. Field, 23,725 shares; John H. Haven and Edward W. Gentz, fifty shares each; John Sehlor, 200 shares. The company has started the manufacture of motors in its new plant and has a large business booked.

# Monroe Doubles Its Capital Stock

## Increases Car Prices—15 M-4 Touring Cars Daily—10 Small Cars

PONTIAC, MICH., April 24—At a meeting of the stockholders of the Monroe Motor Co. held here on April 13 the capital stock was increased from $1,000,000 to $2,000,000. The matter of par value on this stock has not been settled as yet. The board of directors was also increased from five to seven. The two new directors are both distributors of Monroe cars, one being William Small of Indianapolis, and the other L. B. Frint of Milwaukee, Wis.

The price of the car was also increased from $985 to $1,095 on the models M-4 touring and M-5 Club. The price on the small models remains $565 for the roadster, $635 for the Club, and $965 for the sedan.

The Monroe stock is held quite closely, and it is believed that the additional $1,000,000 will be absorbed quietly without an extensively advertised public sale. Of the $2,000,000 issue, $1,500,000 is common and $500,000 preferred.

The Monroe company is in a prosperous condition at the present time. Fifteen of the new M-4 touring cars are being put out a day and about ten of the small models, making a total of twenty-five. This will be increased after May 1 to a total of thirty-five cars.

The Monroe Motor Co. recently took in the plant of the Auto Top & Trim Co. of Pontiac and owns in addition its engine plant in Port Huron, Mich.

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**List Acme Stock in Cleveland**

CLEVELAND, April 21—The National Acme Co. stock has been listed on the Cleveland exchange.

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### CAPITAL CHANGES

KENT, OHIO, April 21—The Mason Tire & Rubber Co. has increased its capital from $1,000,000 to $3,000,000.

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BAY CITY, MICH., April 21—The Union Motor Truck Co. has increased its capital from $45,000 to $90,000.

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KALAMAZOO, MICH., April 21—The Harrow Spring Co. has increased its capital from $500,000 to $600,000.

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DETROIT, April 21—The Schlieder Mfg. Co., maker of poppet valves, has increased its capital from $100,000 to $250,000.

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LANSING, MICH., April 24—The Plymouth Motor Castings Co. has increased its capital from $75,000 to $250,000.

The Kerosene Burning Carburetor Co., Detroit, has increased its capital from $200,000 to $300,000.

The Detroit Auto Dash Co., Detroit,

has increased its capital stock from $30,000 to $100,000.

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CHICAGO, April 20—The Chicago Auto Equipment Co. has increased its capital stock from $2,500 to $15,000.

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ST. LOUIS, MO., April 20—The Jenkins Vulcan Spring Co., manufacturer of the Vulcan automobile spring, has increased its capital from $50,000 to $150,000.

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LANSING, MICH., April 24—The Lozier Motor Co. has decreased its capital from $500,000 to $200,000.

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CLEVELAND, April 20—The H. A. Lozier Co. has decreased its capital from $700,000 to $7,000.

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### Minnesota Passes Blue Sky Law

MINNEAPOLIS, MINN., April 21—The long pending Minnesota blue sky law, which has been before the sessions for 6 years, off and on, has been passed.

The Security Commission, comprising the public examiner, State superintendent of banking and insurance commissioner, has power under it to suspend temporarily all offerings of stock considered fraudulent or unfairly presented and may make such suspension permanent after investigation.

The clause that would make it necessary first to obtain the consent of the commission before offering any stock was eliminated.

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### Hudson Sales Contest

DETROIT, April 19—The Hudson Motor Car Co. is running a sales contest among its dealers on a quota basis. Competition is in three classes.

# Motor Issues Near Low Level

## War Conditions Held Responsible for Heavy Selling—Stocks Are Very Weak

NEW YORK, April 25—Bearish attacks on the automobile stocks have forced quotations down to almost the low level of the year. The depression in motor issues has been due, not to the earnings results of the companies, which to date have been satisfactory, but to what are considered possibilities resulting from the state of war with Germany. Reports from all over the country seem to refute any such argument. Dealers are anticipating record orders because of the large amount of new capital in circulation. Additions are being erected, and all in all, nothing is being left undone which will hamper the sale of cars. The only worry seems to be that of getting the cars from the factories. Reports from the Traffic Department of the National Automobile Chamber of Commerce show no let-up in the demand from the factories for freight cars. The so-called slackening in the demand for automobiles has not materialized, for there is as ever an insistent demand from all over the country and for export trade as well.

Exports of American cars and trucks continue as heavy as ever. March exports are expected to reach at least the $8,000,000 mark. Exports from New York in March alone amounted to over $6,000,000, and it is expected that shipments from the rest of the ports will more than make up for $2,000,000 in additional shipments.

The long-expected report from the United Motors Corp. has been published, showing a healthy condition in the parts and accessory field. Gross sales for the 9 months period ending March 31 were $23,500,000, as compared with $17,200,000 for the corresponding period ending March 31, 1916. The corporation has actual contracts and orders in hand to insure the full operation of its different plants up to July 1, 1918, and if present conditions continue, the sales of the corporation for next year, even outside those from new properties, should considerably exceed those of this year.

The government has stated that it wants the factories and farmers to go on in their work the same as on a peace footing. The demand by the industry for universal training will be a big step toward keeping the skilled workers at their benches in the factories. With the volunteer system in force, many of the laborers would have the right to go into military service and get full pay with promises in most cases of getting their positions back as soon as peace is declared. Now that the government has stated that it wants the skilled mechanics and specialists where they can do the most good, there is little possibility of these men being forced into military service.

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### White Continues Bosch and Eisemann

CLEVELAND, April 23—The White Co. will continue to use Bosch ignition on its passenger car and Eisemann magnetos on its trucks during the coming year as it has for several years past. It was stated in THE AUTOMOBILE for April 12, under "Minor Changes Made in Cars," that White is using Bosch ignition, which was really no change.

## Automobile Securities Quotations on the New York and Detroit Exchanges

| | Bid | Asked | Ch'ge Net |
|---|---|---|---|
| *Ajax Rubber Co. | 67¾ | 70 | — ¼ |
| *J. I. Case T. M. Co. pfd. | 83 | 86 | .. |
| Chalmers Motor Co. com. | 17 | 23 | .. |
| Chalmers Motor Co. pfd. | .. | .. | .. |
| *Chandler Motor Car Co. | 93 | 96 | —5 |
| Chevrolet Motor Co. | 98 | 100 | —12 |
| Fisher Body Corp. com. | .. | 38 | .. |
| Fisher Bord Corp. pfd. | 94 | 96 | .. |
| Fisk Rubber Co. com. | 70 | 75 | .. |
| Fisk Rubber Co. 1st pfd. | 103 | 106 | .. |
| Fisk Rubber Co. 2d pfd. | 92 | 95 | +22 |
| Firestone Tire & Rubber Co. com. | 132 | 137 | .. |
| Firestone Tire & Rubber Co. pfd. | 106 | 108 | .. |
| *General Motors Co. com. | 102¼ | 104¼ | —5¼ |
| *General Motors Co. pfd. | 86¼ | 86½ | +1 |
| *B. F. Goodrich Co. com. | 48½ | 49 | —2¼ |
| *B. F. Goodrich Co. pfd. | 107 | 109 | .. |
| Goodyear Tire & Rubber Co. com. | 215 | 220 | .. |
| Goodyear Tire & Rubber Co. pfd. | 106 | 107½ | .. |
| Grant Motor Car Corp. | 5 | 8 | —1 |
| Hupp Motor Car Corp. com. | 3½ | 4½ | — ¼ |
| Hupp Motor Car Corp. pfd. | 75 | 81 | —3 |
| International Motor Co. com. | .. | 16 | .. |
| International Motor Co. 1st pfd. | .. | 65 | .. |
| International Motor Co. 2d pfd. | .. | 25 | .. |
| *Kelly-Springfield Tire Co. com. | 50 | 52 | —4½ |
| *Kelly-Springfield Tire Co. 1st pfd. | 87 | 91 | —1 |
| *Lee Rubber & Tire Corp. | 20 | 20½ | — ¾ |
| *Maxwell Motor Co., Inc., com. | 48¼ | 48½ | —1½ |
| *Maxwell Motor Co., Inc., 1st pfd. | 66 | 68 | +5 |
| *Maxwell Motor Co., Inc., 2d pfd. | 30¾ | 31½ | + ¾ |
| Miller Rubber Co. com. | 215 | 225 | .. |
| Miller Rubber Co. pfd. | 104½ | 106 | — ½ |
| Packard Motor Car Co. com. | .. | 157 | .. |
| Packard Motor Car Co. pfd. | .. | 101 | .. |
| Paige-Detroit Motor Car Co. | 29 | 31 | —5 |
| Peerless Truck & Motor Corp. | 12 | 15 | —2 |
| Portage Rubber Co. com. | 145 | 150 | .. |
| Portage Rubber Co. pfd. | .. | .. | .. |
| Regal Motor Car Co. pfd. | .. | 24 | .. |
| Reo Motor Car Co. | 27½ | 28½ | —3 |
| *Saxon Motor Car Corp. | 49⅞ | 52 | —2⅛ |
| Springfield Body Corp. com. | 62 | 70 | .. |
| Springfield Body Corp. pfd. | 102 | 112 | —8 |
| *Stewart-Warner Speed. Corp. | 73½ | 74½ | —3 |
| *Studebaker Corp. com. | 85 | 85½ | —5 |
| *Studebaker Corp. pfd. | 104 | 106 | +2 |
| Swinehart Tire & Rubber Co. | 70 | 78 | .. |
| United Motors Corp. | 30 | 30¼ | —4⅛ |
| *U. S. Rubber Co. com. | 57¾ | 58⅓ | — ¼ |
| *U. S. Rubber Co. pfd. | 106¼ | 107¼ | + ¼ |
| *White Motor Co. | 45 | 46 | +2 |
| *Willys-Overland Co. com. | 29⅛ | 29½ | —1⅞ |
| *Willys-Overland Co. pfd. | 95½ | 96 | .. |

*At close April 23, 1917. Listed New York Stock Exchange.

### OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

| | Bid | Asked | Net Ch'ge |
|---|---|---|---|
| Auto Body Co. | .. | 31 | .. |
| Chalmers Motor Co. com. | .. | .. | .. |
| Chalmers Motor Co. pfd. | .. | .. | .. |
| Continental Motor Corp. com. | 7 | 7¼ | — ½ |
| Continental Motor Corp. pfd. | 96¾ | 99 | .. |
| Ford Motor Co. of Canada. | .. | 300 | .. |
| General Motors Co. com. | .. | .. | .. |
| General Motors Co. pfd. | .. | .. | .. |
| Maxwell Motor Co. com. | .. | .. | .. |
| Maxwell Motor Co. 1st pfd. | .. | .. | .. |
| Maxwell Motor Co. 2d pfd. | .. | .. | .. |
| Packard Motor Car Co. com. | .. | 160 | .. |
| Packard Motor Car Co. pfd. | .. | 100¼ | .. |
| Paige-Detroit Motor Car Co. | 30¼ | 31 | .. |
| Prudden Wheel Co. | .. | 24 | .. |
| Reo Motor Car Co. | 28½ | 28⅞ | —2⅛ |
| Studebaker Corp. com. | .. | .. | .. |
| Studebaker Corp pfd. | .. | .. | .. |
| C. M. Hall Lamp Co. | .. | 26 | .. |

INACTIVE STOCKS

| | | | |
|---|---|---|---|
| Atlas Drop Forge Co. | .. | .. | .. |
| Kelsey Wheel Co. | .. | .. | .. |
| Regal Motor Car Co. | .. | 26½ | .. |

# Steam Aeroplanes Predicted

## Doble Experimenting on Steam Power Plant for Aircraft Equipment

DETROIT, April 19—Abner Doble, vice-president of the General Engineering Co., believes that steam as a motive power for aeroplanes may be used in the near future. The power plant of the Doble steam car which is manufactured by the General Engineering Co. develops 1 hp. per 10 lb. weight, which is a better ratio according to Mr. Doble than that of a complete power plant of a gas car and when used in an aeroplane is not encumbered with clutch, change-speed transmission, and starting apparatus, and the ratio of weight to power is greatly reduced. Mr. Doble is experimenting on his power plant for aerial purposes in an endeavor to reduce the weight and expects to lighten the boiler and engine by careful adaptation of design and the use of special materials. The electrical apparatus may be virtually eliminated by taking advantage of the draft supplied by the propeller and the velocity of the plane. Water supply can be greatly reduced for aviation work while the weight of the lubricating oil supply would be negligible. Mr. Doble pointed out that the advantages of a steam power plant lie in longer continuous service, tremendous reserve power, and rapid acceleration.

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### F. T. C. Reports on Gasoline

(*Continued from page* 805)

*That the facts disclose such advances in prices of gasoline and such differences in price corresponding to Standard marketing territories as are not possible of explanation apart from the foregoing conditions.*

*The Commission has not found conclusive evidence of collusion among the various Standard companies in violation of the dissolution decree.*

*That the combination of pipe lines with the other branches of the industry has tended to establish and perpetuate monopoly.*

*That gasoline has deteriorated in quality, a variety of products being sold under that name.*

**Recommendations**

Recommendations of the Commission with a view to preventing or remedying conditions include:

*A law providing for the reopening of anti-trust cases on the application of the Attorney General by a bill of review for the purpose of securing such modifications of decrees as new conditions may require.*

*Abolition, by legislation, in certain cases, of common stock ownership in corporations which have been members of a combination dissolved under the Sherman law.*

*Effective limitation upon common ownership of stock in potentially competitive corporations by withdrawing the power of voting and control.*

*Legislation which, while recognizing common ownership, would fix upon such common owners the responsibility for the acts of each of the several companies so owned, which prevent competition.*

*Segregation of the ownership of the pipe lines from the other branches of the petroleum industry.*

*Fixing, by Congressional legislation, of standards for "gasoline."*

*Federal collection and publication of accurate statistics and information regarding the industry.*

In detail, the Commission urged that when it finds, as in the case of the gasoline industry, an anti-trust dissolution decree has not restored competitive conditions, Congress might amend the Trade Commission act so as to authorize and direct the Attorney General to reopen the case for review as to the efficacy of a dissolution decree. In such proceedings it is suggested that the Commission's findings should be admissible evidence and that the courts should have power to make new decrees to insure competition.

Factors in Standard Oil domination cited in the Commission's report were:

*Division of gasoline marketing into eleven territorial divisions, at least nine of which are said to be dominated by various Standard Oil companies.*

*Stockholders of the several Standard companies are, to a great degree, the same individuals or interests, more than half of the stock of the various companies being in the same hands. Moreover, the report states that leading Standard officers often hold considerable amounts of stock in two or more companies.*

*Standard Oil refineries produced more than 60 per cent of gasoline in 1915, sold about 65 per cent of the total marketed and held more than 70 per cent of gasoline stocks.*

*"Correspondence of the difference of prices (in 1915)," the Commission's report says, "with Standard marketing territories, itself points to arbitrary price making. But the arbitrary character of the inequalities in price is conclusively demonstrated by the facts that as between most of the territories there were no such differences in demand and supply . . . and the margin between cost and price was widely different in the different territories."*

Wholesale prices rose between 75 and 85 per cent in 1915, according to the Commission's report, and retail prices also soared. Only a part of the advance was declared due to increased demand and scarcity, the demand increasing 38 per cent in 1915 and the production but 7 per cent less. Very large profits were formation not touched on here, appears earned, as shown by the books of the companies and by enhanced stock market value of oil securities.

Commissioners making the report are William J. Harris, Joseph E. Davies, William B. Colver and John F. Fort. A digest of the report will be found on page 825.

# 71.7 Miles in 24 Hr. on High Gear

## Chalmers Five Passenger Averages 2.9875 M. P. H.—10 M. P. G.—2½ Pt. Water

DETROIT, April 20—The five-passenger stock Chalmers car completed its 24-hr. demonstration test yesterday, during which time it traveled 71.7 miles. The object was to show the minimum number of miles traveled in 24 hr., for the purpose of illustrating the ability of the car to throttle down at low speed on high gear. The car was sealed in high gear and the standard gear ratio of 4¾ to 1 was used. During the 24 hr. the car stopped four times, two of these due to traffic, one by police, and the fourth due to the engine stalling on an incline. The highest speed made during the 24 hr. was 5 m.p.h., made necessary to avoid traffic. The average speed over the 24 hr. was 2.9875 m.p.h., or practically 3 m.p.h. To demonstrate that the carbureter setting was normal the car was accelerated from 5 to 25 m.p.h. in 12 sec. at the completion of the run. Some of the interesting points regarding the test are as follows:

Water used, 2½ pt.
Battery reading before, 1280.
Battery reading after, 1150.
Lamps used and for how long: Tail light and dimmers, 6 hr. Headlights, none. Dashlight only used while reading speedometer.
Blew horn five times.
Tire inflation 70 lb. in rear, 62 lb. in front.
United States Royal Cords, 32 x 4.
Position of choke lever, lean all the way.
Weight of car loaded, 3400 lb.
Weight of car empty, 2700 lb.
No knock in clutch.
Number of stops of car, four: Two of these traffic stops. Stopped once by police who suggested that in driving rain headlights be used instead of dimmers only.
Two engine stops due to stalled motor on an incline.
Average speed, 2.9875 m.p.h.
Highest speed, 5 m.p.h., made necessary to avoid traffic.
Gas consumption, 7 gal., 1 pt.
Oil consumption nil.
Gas mileage, 10.06 miles to gallon.
Gear ratio, 4¾ to 1.
Distance covered, 71.7.
Acceleration, 5 to 25 miles 12 sec.

—

### Amateur Races for Cincinnati

CINCINNATI, April 20—The local speedway officials are working out a plan for staging three amateur races on May 30, the first of which will be for cars costing less than $1,000; the second for cars from $1,000 to $1,500, and the third for cars costing upward of $1,500. These races will precede the 250-mile race.

Barney Oldfield has entered his Delage, which he will also drive at Uniontown May 10. The Hudson Motor Car Co. has entered two Hudson super-six cars. Ralph Mulford and Ira Vail will drive. If the third car is finished in time it will be entered and driven by Chandler.

—

### Six Detroit Cars at Uniontown

UNIONTOWN, PA., April 24—There will be six cars entered from Detroit in the

May 10 race meet on the local speedway. The Hudson company has entered two cars to be driven by Mulford and Vail. Louis Fontaine will drive a Mercedes for the DePalma Mfg. Co. Louis Chevrolet and Joe Boyer will drive Frontenacs. DePalma has entered his Packard. Oldfield will also start with his Delage.

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### Sues Prest-O-Lite on Back Royalties

NEW YORK, April 23—The Commercial Acetylene Co., owner of the patent under which the Prest-O-Lite Co. is licensed to store acetylene by the acetone process, has brought suit against the Prest-O-Lite Co. The Commercial Acetylene Co. claims that the Prest-O-Lite concern has refused to pay royalties since the Searchlight decision in which the patent was held to have expired because of the expiration of a prior British patent covering the invention. The latter consists in employing tanks containing acetone and an absorbent substance in which acetylene is stored under pressure, the chief feature of the invention being that it safeguards the gas from explosion and the tanks are both safe and convenient to handle.

The Searchlight decision was reversed by the Circuit Court of Appeals, which reversal was sustained by the United States Supreme Court in 1915, and the Commercial Acetylene Co. thus declares that the patent has not expired. An injunction and damages are asked.

The suit is in the United States District Court for the Southern District of New York.

The patent involved in the suit is No. 664,383, granted to George Marie Auguste Claude and George Albert Hess Dec. 25, 1900, who assigned it to Bruno Adbank Abakanowitz of Parc St. Maur, France, assignor to the Commercial Acetylene Co. On March 8, 1905, this concern granted an exclusive license covering use of the invention on automobiles, carriages and other road vehicles to the Concentrated Acetylene Co., predecessor of the Prest-O-Lite Co.

Before equipment of cars with electric starting and lighting systems became common acetylene tanks were used practically entirely for these purposes, and there are still many thousands of cars and trucks in use which employ these tanks. For this reason the replacement business is very extensive and the Prest-O-Lite Co. has been active in protecting its rights by suits brought against offenders in all parts of the country.

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### $2,000,000 Increase in Canadian Sales

MONTREAL, QUE., April 20—In spite of the war, Canadian farmers spent $2,000,000 more for automobiles last year than during the preceding year.

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### A. A. A. Annual Meeting May 25

WASHINGTON, D. C., April 23—The American Automobile Assn. will hold its annual meeting May 25 at Cleveland at the Hollenden Hotel.

# Garages Must Have Oil Separators

## Court of Appeals Upholds Ordinance Requiring Them in New York City

NEW YORK, April 25—Oil separators are necessary and must be installed in all public garages in New York City. This is the gist of an opinion given yesterday by Chief Justice Frank H. Hiscock of the Court of Appeals in Albany, in the case of the Bronx Garage vs. Robert Adamson, Fire Commissioner of the City of New York.

It is stated by the corporation counsel that the ordinance upon which the case hinges will be inforced as soon as practicable and that probably 1000 garages are affected.

President R. H. Johnston of the Automobile Dealers Association, Inc., states that the case will be taken up again with the Board of Aldermen. The first time the association took the matter before this body, the ordinance was unanimously repealed but the repeal was vetoed by Mayor Mitchel. It then went back to be repealed over the Mayor's veto and though a majority of votes was obtained, the move failed.

The opinion practically winds up the now famous oil separator case insofar as the courts are concerned. It has now been through three courts and further action is possible only through the Supreme Court of the United States.

The case hinged about a city ordinance making necessary some sort of a device to prevent gasoline and oil from entering sewers with the waste water from public garages. The ordinance stated that no permit for a garage could be issued until such a separator, approved by the fire department, had been installed.

The Bureau of Combustibles of the Fire Department maintained that sufficient gasoline escaped into sewers to constitute a menace to public safety, and for evidence pointed to several cases of skyrocketing manhole covers which it was alleged were caused by gasoline explosions in the sewers.

The Automobile Dealers Assn., Inc., representing dealers and garages in New York took the matter into the courts, contending (1) that not sufficient gasoline got into the sewers to cause explosions; (2) that no separator had been devised which would effectually separate such small quantities as might pass through drain pipes; and (3) that the ordinance was unnecessary and inflicted a hardship on garagemen because of the excessive cost of the various types of approved separators.

Charles Thaddeus Terry, for the Automobile Dealers Assn., asked the Court of Special Term for a peremptory writ of mandamus which would make compulsory the issuance of licenses to garages without separators. The court refused this but granted an order for a trial by jury to determine whether the law was reasonable. The corporation counsel then took the case to the Appellate Division, which stated that as the ordinance was in effect a statute its reasonableness could not be passed upon by a jury and the measure was entirely up to the Board of Aldermen, which alone had power to alter or repeal the ordinance.

It is this decision of the Appellate Division which the Court of Appeals has now affirmed.

The case is an important one to New York garagemen and it is thought that this decision may have some influence in other cities where separators are not now required but where there has been some agitation by police and fire departments for them.

The ordinance which requires separators follows; it is Article II of Chapter 10 of the Code of Ordinance of the City of New York:

> "No garage permit authorizing the storage of volatile inflammable oil shall be issued for any premises storing more than four motor vehicles which are not provided with an oil separator, trap or other similar apparatus attached to the house drain, for the purpose of preventing volatile, inflammable oils from flowing into the sewer."

The Bureau of Combustibles has formally approved types of oil separators made by seven manufacturers and just a short time ago drew up specifications for its own "Fire Department Oil Separator," which, it affirmed, could be built for about $80 and installed for a total expense not to exceed about $100. This action was induced by the complaints of garagemen that almost any of the approved separators cost anywhere from $300 to $1200 to install.

—

### Fiat Sues on Cored Intake Manifold

NEW YORK, April 23—The Fiat company has brought six suits against automobile and motor truck manufacturers, charging infringement of patent No. 1,190,252 covering the construction of cored intake manifolds. The suits are against the Saxon Motor Car Corp. and the Saxon Motor Car Co. of New York; Moon Motor Car Co. of New York; Hupp Motor Car Corp., Hupmobile Co. of New York, and Charles E. Reiss & Co.; Paige-Detroit Co. of New York, Inc.; Burford & Co., Ltd., and the Garland Automobile Co. Injunctions and damages are asked. The construction outlined in the patents involved in the suit has become more widely used with the increasing trend toward block cylinder casting. The patent was issued to the Fiat company July 4, 1916, as assignee of Guido Fornaca, Turin, Italy, on an application filed Dec. 17, 1909.

Suits are in the United States District Court for the Southern district of New York.

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### Fageol in Start Test

OAKLAND, CAL., April 23—A speed of 25 m.p.h. from a standing start to a full stop in 40 ft. was the record attempted by the Fageol car here recently. The test was made in the ballroom of the Oakland Hotel on a runway 75 ft. long. Claud Fageol and five other passengers were in the car.

The Automobile

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## Concentrate on Fuel

IN order that the automobile industry may achieve its maximum development its engineers must concentrate on the fuel problem. The report of the Federal Trade Commission on the gasoline supply of the country shows that, whereas the horsepower of all gasoline engines sold in 1915 increased 62 per cent in the year over the total horsepower of those sold in 1914, the fuel available was not produced in a correspondingly larger quantity.

The growth of the industry in the past year indicates that the increase in demand has probably been as large again as in the period covered by the report; and this means that the supply of gasoline is steadily becoming less and less adequate to meet the needs of the industry.

There are several ways in which the situation may be met. Carbureter and engine makers can develop their products so that kerosene, distillate and other heavy fuels may be used successfully in automobile and motor truck engines. Various attempts have been made in this direction which give promise of good results. Chemists also have an opportunity here to discover a new product which can be used in place of gasoline. Casing-head gasoline, a by-product of gas works, and benzol, now being used on a large scale for war purposes, are two fuels which may prove commercially useful.

The fact that an association of chemists has met to deliberate on the fuel situation is both a sign that the present shortage demands serious attention, and a hopeful indication that a remedy will be found.

Supply and demand, the federal commission points out, was but one factor in the rising price. It is that factor, however, which the men of the automobile industry are most competent to remedy. Their brains, directed to the development of improved carbureters, engines and gasoline substitutes must find the solution for the great present problem reflected in the rapidly increasing fuel shortage.

## War and Automobile Labor

THE intention of the government, which has been gathered more through hint than statement, is to keep the trained workers in the factories and not to put them in the field. The automobile industry with its thousands of trained machine-shop experts, capable of producing materials as vital in warfare as riflemen, cannot but indorse this intention.

It is very well possible that the genius which has produced an industry of the stature of the automotive development will be one of the trump cards in the hands of the United States.

This labor should be kept in the factories and there is every indication that it will be. The mistakes made by England and France, who were forced to rush their preparations to a far greater extent than we will be, should not be repeated in this country. It became necessary for these countries to call the trained men back from the front and to substitute others. Munitions are just as important as men. The fighting front can only be maintained if there is an efficient support behind the fighting line. The most efficient support that can exist is a large body of well-trained mechanics working in the factories which they know, under foremen with whose directions they are acquainted, and with the tools to which they have become accustomed through long usage. These men are as much a part of the army of the United States as the soldier in the trench.

## Stock Racing Cars

RACING car engineering should be profoundly influenced by the entry into the field of the five Hudson racers developed practically throughout as slight modifications of stock construction. In the past fortunes have been spent in designing and building racing cars entailing practically 100 per cent special work, and yet it is noteworthy that the results attained were by no means commensurate with the task, whereas stock racing cars such as Hudson has produced may be turned out as quantity production propositions at only a slight advance over the price set on the regular factory models. Moreover, such cars would not be unsuited for ordinary road driving, their ability to sustain high speeds for hours at a stretch constituting a valuable power reserve.

The Hudson company expects these racing cars to produce numerous suggestions for improving the stock product, such as better methods of heat treating various parts, improvements in balance, weight modifications, etc. Purely as an engineering investment, stock racing cars should be worth development by manufacturers throughout the industry.

# Horsepower Facts and Fallacies

## Limits of Power and Weight—Cars Average 40 Per Cent Heavy—Fallacies in Multi-Valve Arguments—Fake Power Curves

By A. Ludlow Clayden

HORSEPOWER in an automobile engine is only a means to an end. This seems sufficiently obvious, yet it is a fact that often is not appreciated fully. The end for which we require horsepower is the provision of driving effort at the contact between tire and road. A car with a 100 brake hp. engine may be less good a performer than one with 30 hp. Horsepower alone without any qualification does not mean much.

### Limit of Power Usable

There is a limit for the power which it is possible to use, this being the amount of driving effort that can be exerted without causing the wheels to slip. This is limited in turn by the weight on the driving wheels and the coefficient of friction between the tire and road. Probably the maximum effort that any rubber tire can exert in a tractive direction upon any road is half the weight resting on the tire. If the whole car weighs 4000 lb. and half of this is on the two driving wheels, then each driving wheel can exert a push against the road of half the weight on it, or 500 lb., if the friction coefficient is taken to be 0.5. Probably it is usually less than this, perhaps often as low as 0.3, in which case the two driving wheels could only exert a driving effort of 300 lb.

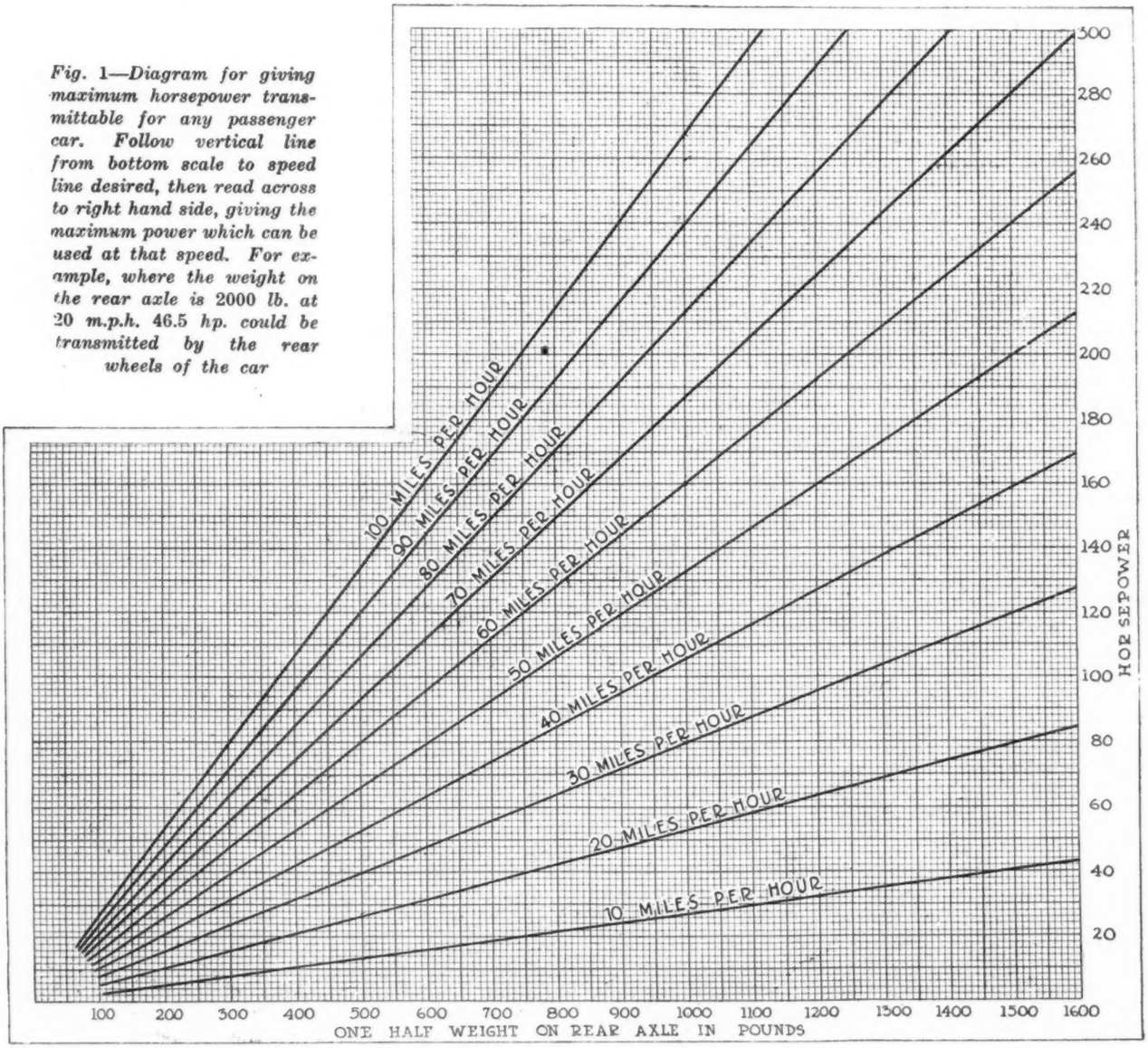

100 MILES PER HOUR
90 MILES PER HOUR
80 MILES PER HOUR
70 MILES PER HOUR
60 MILES PER HOUR
50 MILES PER HOUR
40 MILES PER HOUR
30 MILES PER HOUR
20 MILES PER HOUR
10 MILES PER HOUR
100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600
ONE HALF WEIGHT ON REAR AXLE IN POUNDS
20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
HORSEPOWER

*Fig. 1—Diagram for giving maximum horsepower transmittable for any passenger car. Follow vertical line from bottom scale to speed line desired, then read across to right hand side, giving the maximum power which can be used at that speed. For example, where the weight on the rear axle is 2000 lb. at 20 m.p.h. 46.5 hp. could be transmitted by the rear wheels of the car*

apiece. This means that whatever the power of the engine there are no means whereby the driving force on the car as a whole can be made to exceed from 600 lb. to 1000 lb. according to the frictional coefficient.

A lighter car can transmit less power, of course. Fig. 1 is a diagram of the actual horsepower cars of different weights could transmit at various speeds, but there is an assumption in this tabulation that is not altogether warranted, this being that the coefficient of friction is constant for all speeds. Owing to wheel bouncing, on an ordinary road it is to be doubted whether the 0.5 coefficient holds true much over 20 m.p.h., even under the best conditions. The curve is probably not far off from the truth for a board speedway or very smooth cement.

Now, it follows that maximum "ability" will result when we have the maximum transmittable power available at all speeds. It is very instructive to check up some well-known cars and compare their actual power with the power that could be used in them. One, a car that is well known as a particularly good performer, has the characteristics following:

| M.P.H. | HP. Developed. | Maximum HP. Transmittable | Difference |
|---|---|---|---|
| 10 | 10 | 27 | 17 |
| 20 | 26 | 53 | 27 |
| 30 | 41 | 81 | 40 |
| 40 | 57 | 108 | 51 |
| 50 | 72 | 135 | 63 |
| 60 | 80 | 162 | 82 |

The average racing car weighs about 2500 lb. and develops 120 hp. at 100 m.p.h., while reference to the curve shows that it ought to be able to transmit over 170 hp. Making allowance for the uncertainty regarding the friction coefficient, however, it is probable that the balance of power we have and power we could use in a racing car has nearly been reached. Of course, if we could drive on all four wheels we would have twice the tractive ability, which suggests a momentary speculation as to whether

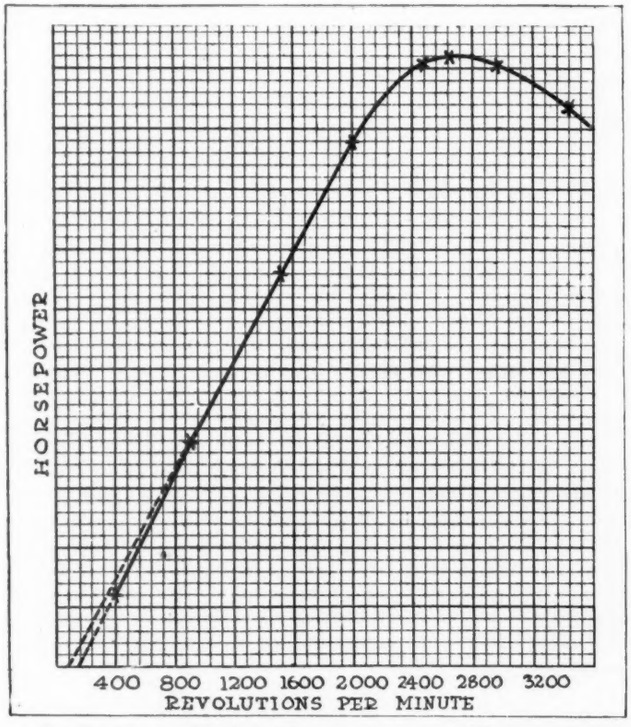



*Fig. 3—A correctly plotted horsepower curve. The crosses are the actual observations. The lower dotted line shows the probable horsepower at lower speed, the upper dash line, the probable horsepower obtainable from 1000 r.p.m. downwards by partially closing the throttle*

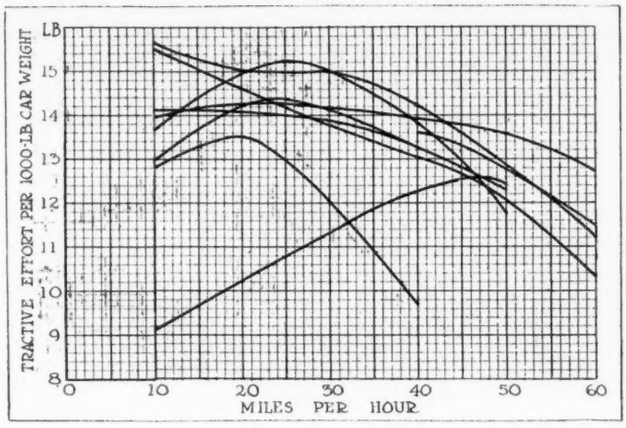



*Fig. 2—Tractive effort pound per 100 lb. of car weight plotted for some well known cars at road speeds from 10 to 60 m.p.h.*

the speed machines of the future may not possibly have a four-wheel drive.

A. P. Brush once stated that the steam engine was nearer the ideal for automobile use than the gas engine, because it could produce the highest torque when there was the least speed. In an internal combustion engine we usually find that the mean effective pressure, and consequently the torque, reaches a maximum somewhere between 20 and 30 m.p.h. on high gear. There are notable exceptions to this rule, but it remains a rule. At low speeds the torque falls off rapidly; still, torque variations are not very great over the normal operating range. Taking a fairly new car which is reckoned a good performer and seems to average up well with modern practice, the torque is found at a maximum at 20 m.p.h. exactly. At 5 m.p.h. it is 90 per cent of the maximum and the same at 45 m.p.h.; from 5 to 45 m.p.h. there is only a 10 per cent variation in torque.

As an example of one of the exceptional designs a popular high-grade car has a maximum torque at 50 m.p.h. At 20 m.p.h. the torque is 89 per cent of the maximum and only 68 per cent at 10 m.p.h.

Now, with a steam engine we can have a constant power output because the product of pressure and speed can be kept constant within limits, but a constant power is *not* what is wanted for maximum performance. What we desire is a constant *tractive effort*, unaffected by speed, and this is no more easily obtainable with steam than with gasoline. With a two-wheel drive and a 0.5 coefficient of friction between tire and road the maximum tractive effort we can handle is 25 lb. per 100 lb. of car weight. Fig. 2 is a diagram showing tractive effort per 100 lb. plotted against speed for some cars of different types. All of them are reckoned fairly good, some very good; there are no cheap cars among them, and fours, sixes, eights and twelves are included.

### Maximum Not Reached

It is immediately noticeable that the best performance of any gives an effort of under 16 lb. at the best speed, compared with the 25 lb. which is theoretically possible. A rough calculation shows that the Stanley steamer can exert a little more than 25 lb. for as long as a full pressure of 600 lb. can be held in the cylinder throughout the stroke, but actually this pressure is never available for more than part stroke and nominal full stroke operation cannot be maintained without lowering the boiler pressure very quickly. However, this is a little outside the consideration of the moment and is only mentioned as forming a somewhat interesting comparison.

Looking again at Fig. 2 it appears that six of the seven

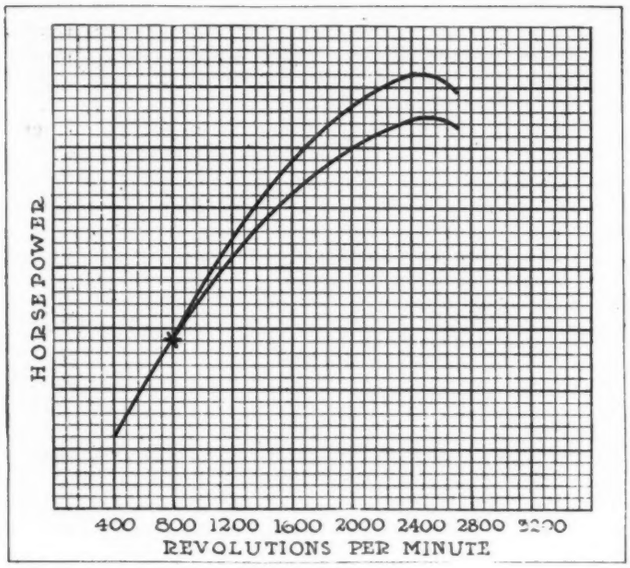



*Fig. 4—Actual curves made from the same engine but with different size carbureters of the same make. With the larger carbureter steady running below the cross marked was impossible at full open throttle*

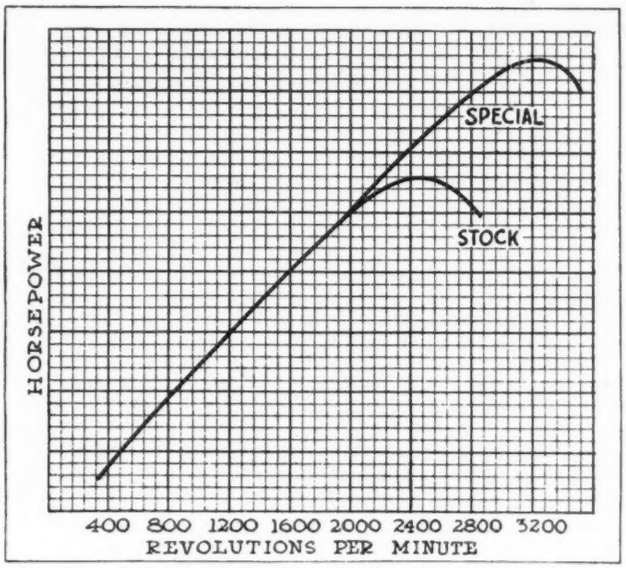



*Fig. 5—An imaginary example of fake power curve drawing. If the upper curve is obtainable by "tuning up" it cannot possibly coincide with the lower curve over the slow speed range as shown here*

engineers have aimed at the best torque at low speed, leaving the high speed to take care of itself, but far more remarkable is the great difference in the shape of the curves. The curves from which these deductions and illustrations were made, by the way, have been submitted to the writer confidentially in every case and are therefore rather more accurate than the general run of "publicity" curves. They represent engines in the stock condition and not especially tuned ones. None the less there is some suspicion that the curves are not entirely reliable *throughout their length*.

It is to be noticed on the originals that the plotting is usually made from five or six readings, and some of these have the lowest speed reading in excess of the engine speed at 10 m.p.h. At the present time the greatest difficulty is to get efficient carburetion over a wide range. Suppose an engine is set up on the test block and adjusted to pull well at 1000 r.p.m. with wide open throttle; then if the load is increased the speed will come down till a point is reached where steady and reliable pulling is no longer possible. This has been called the "stagger spot" and the term is descriptive. Suppose such a stagger spot is found at 600 r.p.m., the engine may run for an hour at full throttle at 650 and refuse to run two minutes at 580. Under such circumstances it does not produce a true power curve to draw a line from the 600 reading straight to the origin, yet this is quite a usual way of completing a curve.

### A Correct Power Curve

A curve correctly plotted is shown in Fig. 3 and it is seen that the last point actually observed is at 400 r.p.m. Continuing the line, shown dotted, there will be zero horsepower at 200 r.p.m. Closing the throttle would probably begin to assist the power just about the 400 point; in fact, since the engine in question will pull well at 150 revolutions, the dash line curve from 1000 r.p.m. down could probably be obtained without difficulty.

In Fig. 4 is a comparison of two curves made from the same engine with carbureters of similar design but different size. Taking the better high-speed curve it will be seen that this approaches the lower one steadily, till they fairly well coincide at 800 r.p.m. Here the better curve really ends. With the large carbureter steady pulling at 700 was possible with full throttle, but it was not reliable. With the smaller instrument full throttle operation down to 400 r.p.m. was certain, but at the expense of a loss of power at from 1500 up.

Here we see how easy it is to make a misleading curve, for having investigated the range from 800 to 2000 on the large carbureter we should have a beautiful straight line power curve which looks just as though it would continue down to about 100 r.p.m. The temptation to draw it in is almost irresistible.

A third carbureter tried on the same engine was still smaller and showed a better reading below 600 with steady pulling at a little over 200 with full throttle, but the power at 2000 was 10 per cent less than with the medium-size instrument. Since the design was altogether different, however, the curve is not shown, as the comparison is not accurate throughout the range.

Now, the most interesting thing is that even the largest carbureter used was far smaller than the "breathing capacity" of the engine. That is, the intake passage and the valves were large enough to fill the cylinder at a much lower velocity of gas than the velocity through the carbureter. Taking a larger carbureter still it would probably be found that the stagger point was raised to 1000 or even more, and that while the maximum power might be raised 20 per cent by using the full breathing capacity of the engine it would not be possible to use full throttle below 1000 revolutions, corresponding to about 25 m.p.h. with normal gearing.

This brings us to the interesting conclusion that increasing the valve size or lift or using more than two valves per cylinder could not help the power curve *throughout* the range of normal operation. The timing used on this engine is one proved to give a peak about 2500 r.p.m. That is to say the peak could not be raised much above this point by any system of carburetion, but the car is then traveling at 62.5 m.p.h., which is quite the limit desired for a normal sort of machine. A higher speed timing would still further cut down the power at low speed.

### Faking Power Curves

With this preface, attention may be called to a practice which has been followed by a few of showing the stock engine in normal condition and the same engine "tuned up" something after the style of the curves in

Fig. 5. Frankly, such curves are not possible. Doubtless in a majority of cases the normal condition curve is fairly accurate, and the tuned up curve as well *above a certain speed.* But unless the normal condition of the engine is an extremely poor one it is not possible to carry the power peak up 500 revolutions or so and still have more power, or even the same power at the low speeds. The departure from the truth is caused by drawing a good-looking straight line downward from the last observation. The sending out of curves of this sort is much to be condemned, not because they deceive engineers, but because they damage the reputation of the manufacturer in question with his own customers, who wonder why all the cars of that make cannot have the tuned-up product.

Except as a matter of engineering interest the horsepower curve is of little value. It is of the very least value because of the habit of plotting it against revolutions or sometimes against piston speed. Horsepower plotted against car speed in m.p.h. would be far more instructive and would tell the car user much more than a statement of tractive effort. For example, suppose a manufacturer anxious to feature the power of his product sent out a curve like *A* and *B*, Fig. 6, for another car would show a difference in terms that an average man can appreciate. Looking at such a chart and seeing that one car had 5 hp. more available at 20 m.p.h. than the other means more to almost anybody, engineer or not, than a statement that the tractive efforts for the two are y lb. and x lb. respectively at 20 m.p.h.

In Fig. 7 are shown the power curves of the seven engines the analysis of which formed the basis for this article, plotted against m.p.h. Fig. 8 shows a still better comparison, for it has the horsepower per 1000 lb. of weight instead of the total power. All things considered, Fig. 8 seems as nearly ideal a way of comparing ability on paper as we have available. Of course, it only holds true as a comparison below the speeds where wind resistance begins to become the more important factor. For acceleration and for hill climbing the power per unit of weight gives the true perspective. For speed it does not do so above 30 m.p.h. Probably the speed ability is indicated fairly well by the position of the peak of the curve, at least such seems to be the case judging from knowledge of the performance of the seven cars in question.

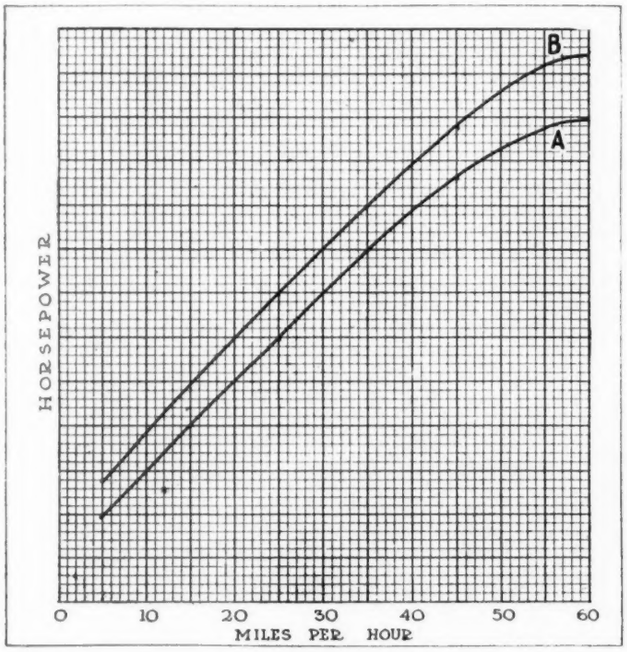



*Fig. 6—How comparative curves for different cars might be made by plotting horsepower against miles per hour. Fig. 8 is a better comparison still*

It will be noticed that the curves in Fig. 8 lie very close together, at least up to about 40 m.p.h. they do so. For example, notice the 30 m.p.h. point and it is seen that six of the seven cars have at that speed between 11 and 12 hp. per 1000 lb. Also it is to be seen that the only one of the seven which is below 11 hp. at 30 m.p.h. has the best curve above 40 m.p.h.

Shown in line A in Fig. 8 is the average for the seven cars, modified by averaging for six only at 50 and at 60 m.p.h., since one car is obviously not intended to operate at these speeds. Remembering that these are all fairly good to very good cars we can make certain definite deductions from the diagram. For example, a curve just a trifle better than the average, yet no better than that obtained for some cars would be:

| M.P.H. | Hp. per 1000 lb. |
|---|---|
| 10 | 4 |
| 20 | 8 |
| 30 | 12 |

Nobody apparently has been able to carry this on to 40 m.p.h. in the straight line. One may therefore say that a good "bogy" would be 4 hp. per 1000 lb. per 10 m.p.h.

Fig. 8 also shows the average curve for the cars together with the curve of theoretical maximum transmittable horsepower. This comparison can be instructively analyzed to show what percentage we have of the total that could be used giving the figures following:

| M.P.H. | Maximum hp. transmittable. | Actual hp. | Equals per cent. |
|---|---|---|---|
| 10 | 6.6 | 3.48 | 52 |
| 20 | 13.3 | 8 | 60 |
| 30 | 19.9 | 11.3 | 56 |
| 40 | 26.6 | 14.4 | 54 |
| 50 | 33.3 | 16.8 | 50 |
| 60 | 39.9 | 17.5 | 44 |

This shows how large a drop in gear ratio gives us all that can be used. For example, take the speed of 20 m.p.h. where we could use 13.3 hp. per 1000 lb. Next look at the average actual power curve in Fig. 8, and we see that 13.3 is available at 36 m.p.h. This means, of course, that the engine speed corresponding to 36 m.p.h. with the high-gear ratio would give us maximum transmittable power at 20 m.p.h., if the ratio drop is correct. In other words, if we choose a low gear to give us the maximum transmittable horsepower at 20 m.p.h. its ratio will be 1.8 times the ratio of the high gear. If the high gear is 4.5 to 1 the lowest gear we can make use of at 20 m.p.h. will be 4.5 x 1.8, or 8.1 to 1.

### Determining Indirect Gear Ratios

Let us see what this gear ratio reduction does at other points on the speed curve. At 10 m.p.h. it would give an available 7 hp. more than can be used. At 30 m.p.h. it would give 17.2 hp. per 1000 lb., and this is about the peak of the curve.

Of course there is one thing that must not be overlooked here, and this is the drop in transmission efficiency due to the introduction of the spur gear reduction. Just what this is is variously estimated, but the usual stock gearset has the intermediate gear of the three speeds about 1.7 to 1 and we know from experience that this is low enough for almost all circumstances. It means that a ratio for the lowest gear of all of 2.5 to 1 in the gearset, should be sufficient for all circumstances, even allowing

for the fact that the engine in the hands of the average man will not maintain its original condition.

Of course there are conditions like deep sand with a fairly firm bottom where the coefficient of friction may rise above 0.5. Probably to be really safe the lowest gear should not be much higher than three times the direct drive, 13.5 to 1 where the high gear is 4.5 to 1. It seems rather surprising to think that we are as close to this in proportions of engine power and light weight.

Now, to attack the subject from the weight viewpoint only. Take the average curve from Fig. 8 and let us see what the car would have to weigh to reach the limit of traction; in other words, assuming the same engine, how light could the car be?

Taking the column of maximum and actual horsepowers in the last tabulation above, these can be regarded as weight comparisons also. For example, we see that the nearest approach between the two is at 20 m.p.h., when the actual power is 60 per cent of the maximum. This means that if we could leave the power the same and cut the weight 40 per cent we should have the limiting condition attained in a different way.

Again tabulating, the weight to bring the average curve to coincide with the ideal could be cut as follows:

| M.P.H. | Per cent Cut. | M.P.H. | Per cent Cut. |
|---|---|---|---|
| 10 | 48 | 40 | 46 |
| 20 | 40 | 50 | 50 |
| 30 | 44 | 60 | 56 |

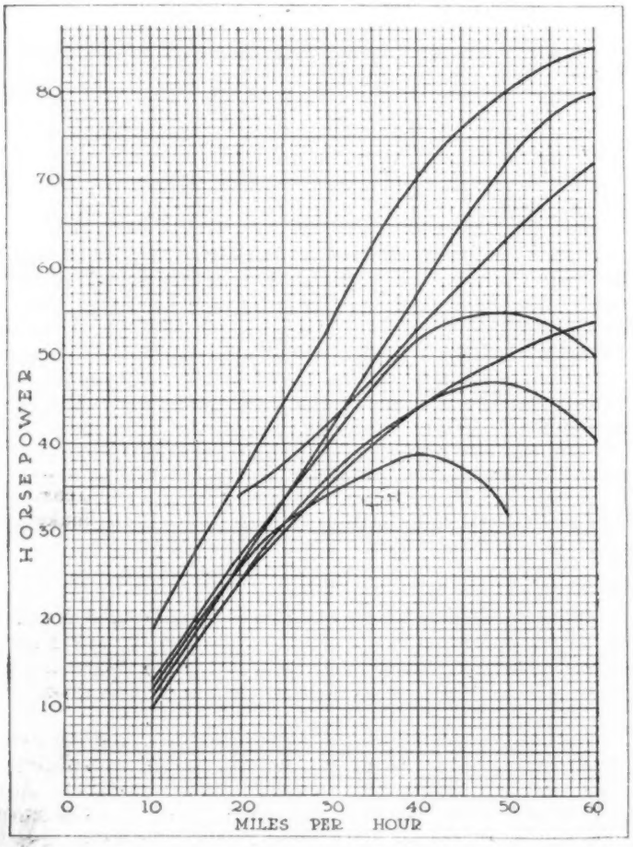
This means that there is still, on the average, a good 40 per cent of waste weight in a high-grade automobile. The best of the cars plotted in Fig. 8 could dispense with 38 per cent of its weight at 20 m.p.h.

Let us see what this means in a definite case. With a car weighing 3000 lb. in round figures it is not difficult to get 24 hp. at 20 m.p.h. on a reasonably high gear. There are several cars that do as well as this. This means that such a car is exactly 40 per cent too heavy for best performance at this speed, or that its ideal weight should be 1800 lb. The weight of such an engine with all its accessories, cooling system, etc., would seldom be less than 400 lb., in fact 400 lb. would be fairly good. So the rest of the car should weigh only 1400 lb.

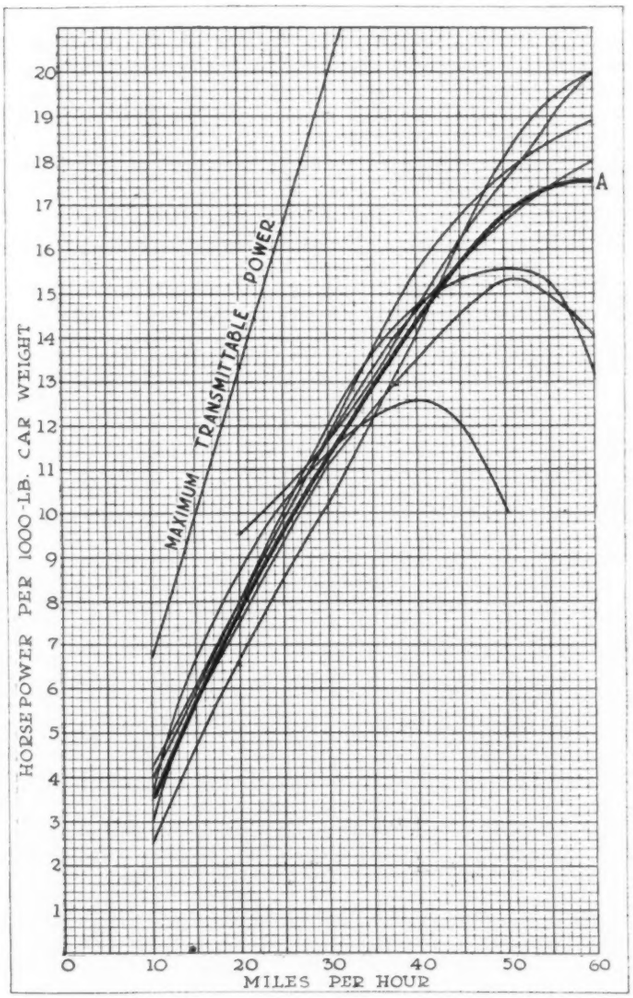
### Cutting Power Plant Weight

Can such a cut be made? At present it certainly cannot, but with the knowledge gained of light-engine building from aviation work we may see big cuts in the weight of power plants. At present the best weight for an aviation engine with all cooling system, etc., is about 4 lb. per horsepower.

Yet another interesting way to study the collection of curves in the diagrams illustrating this article is to consider what they represent in acceleration possibilities. If the maximum tractive force per 100 lb. of car weight is 25 lb. this represents the limit of accelerative ability on any gear ratio, and 25 lb. per 100 lb. moved can produce an acceleration of just 8 ft. per sec. per sec. Now, about the best effort we can get in practice, judging by the diagrams, is 15 lb. of effort per 100 lb. weight, giving a maximum acceleration of 4.8 ft. per sec. per sec.




*Left—Fig. 7—Seven different curves showing well known cars' power output at different speeds*




*Right—Fig. 8—The same seven cars compared on a basis of power per 1000 lb. of weight at different speeds. The curve A is an approximate average of the seven, the straight line shows the maximum power that could be transmitted*

# Automobile Industry Chief Factor in Gasoline Demand

## Federal Trade Commission Report Shows That Total Horsepower of Cars and Trucks Sold in 1915 Was 65% Greater Than in 1914—Gasoline Cost Statistics

¶ EDITOR'S NOTE—*In accordance with certain Senate resolutions the Federal Trade Commission is conducting an investigation of the petroleum industry. During the latter part of 1915 numerous complaints from all parts of the country came to the Commission, charging that the price of gasoline was unreasonably high, and that gross discriminations in price were being practised by refiners and others. These complaints were of such a character and so numerous that the Commission deemed it in the public interest to make a special investigation. The report digested herewith is the result of that inquiry.*

THE chief element in the demand for gasoline is the internal-combustion engine. Inquiries by the Commission show rapidly increasing sales of all types of gasoline engines during the last 3 years. Over 270 manufacturers of motors or engines using gasoline as fuel have furnished information to the Commission concerning their sales. Though returns could not be secured from some who had gone out of business in 1916, and the figures consequently are too small for the earlier years, the data indicate an important increase in 1915 over 1914. A condensed table, showing the total horsepower of domestic sales, appears herewith.

This table indicates that the horsepower of gasoline engines sold in 1915 was approximately 62 per cent above that of the engines sold in 1914.

The sales of gasoline by refiners increased from the beginning of 1915 until September, remaining high thereafter until November, and, though decreased, were much higher in November and December than they had been in January of the same year. Returns from refiners reporting to the Commission show an increase of 38 per cent in sales of gasoline and naphtha to jobbers and consumers during 1915 as compared with 1914. This evidence of increased demand is borne out by reports from over 1000 garages, scattered over every State in the Union, which show an increase of 16 per cent in total gallons of gasoline sold in 1915 over 1914.

The exports of gasoline products (gasoline, naphtha, and benzine) were over 315,400,000 gal. during 1915 and 209,546,000 gal. during 1914, an increase in exports of over 50 per cent. These figures are compiled from the reports made to the Commission by practically all refiners in the United States. The statistics of the Bureau of Foreign and Domestic Commerce indicate the movement of exports by months and show that they reached a maximum in August, 1915. The exports during the remainder of the year, however, show a decline. As reported by refiners to the Commission, 1915 exports were over 20 per cent of the gasoline and naphtha produced by the same refiners in 1915. In 1914 exports were approximately 18 per cent of the quantity manufactured. This increase in exports, though small compared with the total quantity produced, was one factor in causing the advance in the price of gasoline.

**Horsepower of Gasoline Engines Sold Yearly**

| Year. | All gasoline engines, total horsepower | Per cent increase | Automobiles and motor trucks, total horsepower | Per cent increase |
|---|---|---|---|---|
| 1913..... | *11,279,143 | ..... | *7,561,972 | ..... |
| 1914..... | *13,887,331 | *23 | *10,449,937 | *38 |
| 1915..... | 22,524,858 | *62 | 17,263,382 | *65 |

*The figures for 1913 and 1914 are less than the total produced, and consequently the percentages of increase in 1914 and 1915 as they appear in the table are too large.

### Costs and Margins

An analysis of costs and f.o.b. refinery prices of gasoline and other petroleum products shows that both the f.o.b. refinery price of gasoline and also the refinery returns from the whole group of refined products in 1915 rose to a greater extent than the cost of production. The margin of profit increased with the great majority of refiners between July and December, 1915. This conclusion, based upon costs and f.o.b. refinery prices, is substantiated by increased net earnings during the latter part of 1915.

These statements of fact apply both to Standard companies and to other large refiners.

Summed up, the facts are as follows: The chief element in increased cost of refined products is the increased cost of crude petroleum, as it constituted approximately 80 per cent of the cost of gasoline at most of the important refineries in 1915. There were during 1915 increases in the cost of certain materials, such as sulphuric acid and caustic soda, but these were generally only a little over 1 per cent of the total cost.

For a group of four large eastern refineries, which used mixed crude oils, chiefly from the Oklahoma and Appalachian fields, the average reported book cost of the crude oil used advanced between July and December, 1915, from 3.90 cents to 4.93 cents, an increase of 1.03 cents per gallon; the average value of all the products from a gallon of crude, allowing for loss, advanced from 6.40 cents to 8.28 cents, an increase of 1.88 cents; the average advance in the price of the quantity of gasoline obtained from a gallon of crude was 1.33 cents. This 1.33 cents is the amount of the increase in f.o.b. refinery price of the quantity of gasoline obtained from a gallon of crude oil, and is equal to over 6 cents per gallon of gasoline; it is included in the combined products, the total advance of which was 1.88 cents.

For four large Standard refiners and three medium-sized other companies using practically nothing but Mid-Continent crude oil and all producing lubricating

oils, the average reported book cost of crude oil used advanced between July and December, 1915, from 1.86 cents to 3.14 cents, an increase of 1.28 cents per gallon; the average value of all the products from a gallon of crude, allowing for loss, advanced from 4.43 cents per gallon to 6.36 cents, an increase of 1.93 cents; the average advance in the price of the quantity of gasoline obtained from a gallon of crude was 1.14 cents, or over 5 cents per gallon of gasoline.

The average reported book costs for a group of four refineries using Cushing crude were 1.13 cents in July and 3.31 cents in December, 1915, an increase of 2.18 cents; the average f.o.b. refinery price of all the products from a gallon of crude, allowing for loss, advanced 2.54 cents during the same period; the average advance in price of the gasoline obtained from a gallon of crude oil was 1.86 cents, or over 6 cents per gallon of gasoline.

**Average Advances in Cost of Crude and Price of Products, July to December, 1915 (Cents Per Gallon)**

| Item | Refiners Using Oklahoma and Appalachian Mixed Crude Oils | Refiners Using Mid-Continent Crude Oil | Refiners Using Cushing Crude Oil |
|---|---|---|---|
| Average advance in book cost of crude oil | 1.03 | 1.28 | 2.18 |
| Average advance in refinery price of all products | 1.88 | 1.93 | 2.54 |
| Average advance in refinery price of the quantity of gasoline obtained from a gallon of crude | 1.33 | 1.14 | 1.86 |

All the refineries included show increased margins between the cost of a gallon of crude oil and the refinery price of the products from a gallon of crude oil, the increases being 0.85 cent for the refineries using Oklahoma and Appalachian mixed crudes; 0.65 cent for Mid-Continent, and 0.36 cent for Cushing. As there are 42 gallons in a barrel of crude oil, these increased margins between crude oil and the products obtained therefrom mean increases of about 35 cents, 27 cents, and 15 cents, respectively, per barrel.

As these representative refiners were not losing in July, it is apparent that in December they were making from 15 to 35 cents more profit on each barrel of crude oil refined. A refinery, therefore, which used 1,000,000 barrels of crude in December might have made an increased profit of, say, $250,000 for the month.

The foregoing figures show that the price of gasoline during the latter part of 1915 advanced to a greater extent than the cost of crude oil used. The cost of crude oil, however, is not the total cost of refining. It remains to ascertain whether the price was sufficient to cover all costs in the middle of 1915, and whether the margins above cost increased thereafter. An examination has been made of the books of a group of refineries chosen for their representative character, and the cost and the margin per gallon of gasoline have been computed. These are shown in the accompanying table. The method used is that of treating products other than gasoline as by-products, and accordingly the total cost of refining the crude has first been charged to gasoline. Then this cost has been reduced by the amount of the current value of the by-products currently produced. The result is the maximum amount of all the expenses of refining that can be charged to gasoline currently produced.

To recapitulate, the investigation of the petroleum industry by the Commission shows that a decreasing supply of light crudes, coupled with increasing foreign and domestic demands, explains a part of the advance in gasoline prices during 1915, but that part of the advance in certain sections, at least, was unnecessary and to a certain extent due to artificial conditions.

COSTS (ALLOWING FOR GAINS AND LOSSES ON OTHER PRODUCTS), PRICES AND MARGINS PER GALLON OF GASOLINE PRODUCED AT REPRESENTATIV REFINERIES, BY 6-MONTH PERIODS, AND BY MONTHS JULY-DECEMBER, 1915

(All Figures in Cents per Gallon)

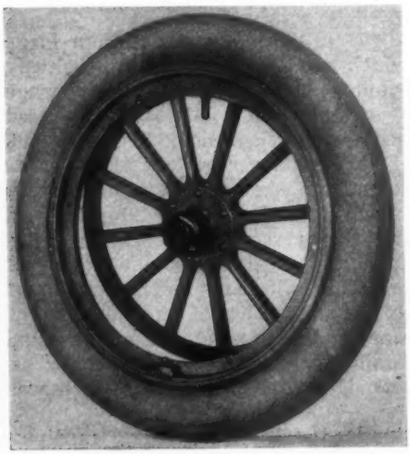
| Company and Item | By 6-Month Periods: Jan.-June | July Dec. | Increase | By Months: July | Aug. | Sept. | Oct. | Nov. | Dec. | Increase July-Dec. |
|---|---|---|---|---|---|---|---|---|---|---|
| Standard of New York, Buffalo plant: | | | | | | | | | | |
| Cost | 6.15 | 6.54 | 0.39 | 5.55 | 5.19 | 6.33 | 6.71 | 7.41 | 7.27 | 1.72 |
| F.o.b. refinery price | 7.21 | 10.25 | 3.04 | 8.03 | 8.98 | 10.59 | 11.29 | 12.20 | 13.72 | 5.69 |
| Margin | 1.06 | 3.71 | 2.65 | 2.48 | 3.79 | 4.26 | 4.58 | 4.79 | 6.45 | 3.97 |
| Atlantic Refining Co., Philadelphia plant: | | | | | | | | | | |
| Cost* | 1.19 | 3.82 | 2.63 | 1.60 | 3.65 | 2.72 | 4.22 | 6.57 | 5.92 | 4.32 |
| F.o.b. refinery price | 8.97 | 10.29 | 1.32 | 8.18 | 9.00 | 9.63 | 11.21 | 11.88 | 13.50 | 5.32 |
| Margin* | 7.78 | 6.47 | −1.31 | 6.58 | 5.35 | 6.91 | 6.99 | 5.31 | 7.58 | 1.00 |
| Company A: | | | | | | | | | | |
| Cost | 8.23 | 8.65 | .42 | 7.01 | 6.15 | 7.05 | 11.43 | 9.69 | 9.33 | 2.32 |
| F.o.b. refinery price | 8.54 | 11.43 | 2.89 | 8.85 | 9.60 | 10.77 | 11.65 | 13.00 | 15.46 | 6.61 |
| Margin | .31 | 2.78 | 2.47 | 1.84 | 3.45 | 3.72 | .22 | 3.31 | 6.13 | 4.29 |
| Standard of Indiana: Whiting plant— | | | | | | | | | | |
| Cost | 3.11 | 4.07 | .96 | 2.39 | 3.09 | 4.45 | 4.58 | 4.64 | 5.25 | 2.86 |
| F.o.b. refinery price | 7.24 | 8.27 | 1.03 | 6.72 | 6.89 | 7.41 | 8.57 | 10.04 | 11.84 | 5.12 |
| Margin | 4.13 | 4.20 | .07 | 4.33 | 3.80 | 2.96 | 3.99 | 5.40 | 6.59 | 2.26 |
| Sugar Creek plant— | | | | | | | | | | |
| Cost | 4.97 | 5.99 | 1.02 | 4.39 | 5.58 | 6.82 | 7.22 | 6.25 | 5.94 | 1.55 |
| F.o.b. refinery price | 6.10 | 7.10 | 1.00 | 5.79 | 5.82 | 6.39 | 7.28 | 9.08 | 10.95 | 5.16 |
| Margin | 1.13 | 1.11 | −.02 | 1.40 | .24 | −.43 | .06 | 2.83 | 5.01 | 3.61 |
| Company B: | | | | | | | | | | |
| Cost | 5.05 | 5.23 | .18 | 3.14 | 3.16 | 6.13 | 5.13 | 5.54 | 7.10 | 3.96 |
| F.o.b. refinery price | 5.95 | 8.13 | 2.18 | 5.82 | 5.91 | 6.72 | 8.42 | 9.47 | 10.73 | 4.91 |
| Margin | .90 | 2.90 | 2.00 | 2.68 | 2.75 | .59 | 3.29 | 3.93 | 3.63 | .95 |

*The Atlantic Refining Co.'s cost of gasoline is made unduly low, and its margin unduly high by the method used in this table. This is true for the reason that the company's lubricating oil is a main product showing a margin of gain, which has been deducted from cost of gasoline.

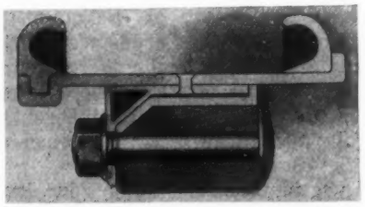
## To License Car Makers Under Johnson Demountable Rim Patent

AFTER July 1 automobile manufacturers can secure licenses under the Johnson demountable rim patent No. 965,715, which has been under exclusive license to the Pierce-Arrow Motor Car Co., Buffalo, for the past 5 years. The license held by the Pierce-Arrow company to manufacture demountable rims under this patent covers the period from July 1, 1912, to July 1, 1917, on which date it will expire. On account of the greatly increased demand for dependable demountable rims by the various automobile manufacturers, Mr. Johnson, owner of the patent, has decided to place the construction in the open market, so that all car makers who desire can use this type of rim by securing a license.

As shown by the accompanying illustration of the rim mounted on a wheel, and in section, it is very simple and may be easily and quickly applied or detached.



Johnson demountable rim, showing mounting on wheel



Section through Johnson demountable rim construction

# Fan Is Important Cooling Factor

## Possibilities of Securing Maximum Fan Efficiency Frequently Overlooked by Engineers, Schanze Tells Cleveland S. A. E.—Points of Defects in Water Jacket Design and Pump Arrangement

CLEVELAND, April 21.—In his paper on "Automobile Engine Cooling," read before the Cleveland Section of the Society of Automotive Engineers last night, A. K. Schanze, Pitter Fan Co., stated that the importance of the fan as a factor in engine cooling is frequently overlooked and its possible efficiency is lost. Mr. Schanze also pointed out very clearly the necessity of unrestricted and ample water jackets especially in engines using the thermo-syphon cooling system. He stated that in a number of engines which had come under his supervision the radiators and circulating pumps were of such design that the water was all pumped out of the bottom of the radiator, so that for short intervals there was really no circulation taking place in the engine until the water had again reached the bottom of the radiator at which point the pump was located.

In analyzing the service of radiator-cooling fans, their pulleys and bearings, Mr. Schanze stated that better fans would do much to cut the cost of radiator manufacture, besides doing away with objectionable noises and other troubles. In his experience the multi-blade fan has proved far more powerful and efficient than any other type yet produced, giving far more breeze at a much smaller rate of power consumption.

At the conclusion of the paper, Louis Schwitzer, production manager of the Empire Automobile Co., took exception to this statement. He said that in road tests the flat-blade fan had been found more satisfactory, and substantiated his statements with several figures. Mr. Schanze replied that he could not understand this, and asked Mr. Schwitzer to furnish him with reports of the various tests.

Stephen Jenecick, of the Climax Motor Devices, said that the reason for Mr. Schwitzer's statement was the fact that the multi-blade fan was so much more efficient, that it delivered far more air than could escape from behind the radiator and under the hood. Mr. Jenecick also said that there were plenty of very excellent data available for fan design, and that it still remains a question for the automobile designer to decide as to the amount of air necessary, available radiator space, etc. These given, the fan and radiator manufacturers would have definite specifications to work upon.

Mr. Schanze's paper follows:

## Automobile Engine Cooling

By A. K. Schanze
*Pitter Fan Co.*

IN taking up the subject of cooling internal combustion engines on automobiles, trucks and tractor engines in this paper, it was the intention of the author to devote particular time and attention to the fan and its performance. However, the other factors in the cooling system, namely, the radiator, the water jacket and the circulation, are so closely interlinked in their performance, with the performance of the fan, that it would be an incomplete discussion of the subject that did not take them well into consideration.

This paper will deal with water cooled motors only; and no discussion on air cooled systems will be here taken up.

The cooling system of the internal combustion engine as now applied on a majority of pleasure cars, trucks, and tractors, normally divides itself into four main units.

These are: the water jacket around the motor; the circulating system; the radiator and the fan.

The order in which these have been named seems to be the order of their importance in the minds of most engineers, consciously, or otherwise. It seems, at least, that this is about the historical order in which real scientific research and practical development took place on the cooling systems to-day in use.

### All Cooling Systems Equally Important

The author of this paper wishes to be recorded as being of the opinion that no order of relative importance can be assigned to these four subdivisions of the cooling system. They form a chain whose strength is only that of the weak link, and wherever there is a system in which one of the four parts falls below its proper standard of balance, there lies an imperfection in that system which should be remedied.

Cooling systems give outward evidence of imperfections in two general ways; they over-cool or they under-cool. Of the two, the latter is far and away the more common.

Now, to take the discussion up in its parts, let us begin with the water jacket. Its function, as we all realize, is to carry a quantity of water of such volume that it will take away from the cylinder walls only that heat that cannot be converted directly into mechanical energy, and the accumulation of which would be destructive to the material of which the cylinder is made. From such a definition, it would appear that, given the number of heat units generated, the mechanical work to be done, and the heat units in excess of the latter requirements, a water jacket would be a simple matter to design.

### Few Water Jackets Ideal

Perhaps it is, but its simplicity is evidently a secret in possession of a comparatively limited number of engineers. It has been the writer's experience, during the various fan tests that he has conducted on cars of many different makes, to come across three or four apparently ideal water jacket designs. In the main, water jackets leave some room for improvement.

The mere solution of the problem of what *volume* of water a jacket must contain does not produce the answer to the problem. The *distribution* of the water layers around the cylinder walls may take on an aspect of even greater importance than the volume. Since ignition takes place in the top of the cylinder, the top is longest exposed to fire and becomes hottest. Modern engineering practice has placed the deepest layer of cooling water over the top of the cylinder, which is as it should be. However, the foundry practice in some cases seems to have interposed stiffening ribs or small columns on top of the cylinder. These act as retarders to the circulation with the result that steam pockets seem to be formed. This shows itself in some engines whose waterjacket volumes are adequate, in the sudden jump in temperature that takes place when the motor stops.

It has come to the author's notice on several occasions in

tests, that, when the motor was stopped, the temperature recorder by a thermometer placed in the filler cap mounted from 200 to 220 deg. Fahr. After losing two thermometers through having them blown out of an improvised bushing in a hole in the filler cap and seeing a jet of steam shoot 20 ft. into the air from a radiator that, a moment before had not been near the boiling point, we became cautious and observant. Thermometers lashed in place showed that temperatures went to 220 deg. Fahr. Repeated experiments over the same ground could lead only to the conclusion that the whole mass of water was not being raised through that range of temperature in 40 or 50 sec., but some little patch on top of the cylinder was being converted to steam and the filler neck was being used as a steam dome faster than it could act as a relief through the overflow.

This condition or the approach to it seems to have become such a common thing in some localities that the engineers concerned have become used to it and do not lay much stress upon its presence.

### A Mechanical Danger

Wherever a design of water jacket allows of such a condition, every effort should be made to get rid of it. The condition is dangerous to the mechanical structure of the machine from an economic standpoint and is dangerous to people working around a car. The mechanical danger lies essentially in the radiator where the large areas and thin structures are not designed to carry pressure. Steam above 212 deg. means pressure, and there is no doubt that many a radiator manufacturer has been called upon to replace a leaky radiator that was really not defective in its own right.

The danger to human beings lies in the possibility of a clogged overflow pipe, and an unsuspecting person taking a look into the filler neck at the psychological moment. The writer was witness to one such case about one year ago where a man had his face severely scalded.

The water layer, then, over the top of the cylinder should not only be calculated upon a basis of its total volume, but should also be so arranged that the circulating system will handle all of it at a uniform rate, and so that, when the circulating system ceases to function, by virtue of the stopping of the engine, the layer will have a thickness such as to afford sufficient reserve to absorb the heat that remains in the cylinder after the last explosion, and no more heat is being added.

Referring again to the cooling system as a whole and regarding that phase of its operation which is described as over-cooling, we need scarcely fear that over-cooling will come from the jacket alone.

### Preventing Pre-Ignition

Tests conducted by various authorities on internal combustion engines indicate that high compression contributes the largest percentage of total efficiency of the gas engine. High compression is always attended by the danger of pre-ignition unless the cooling system can overcome the tendency. If the cylinder walls are cool, the gas upon entering the cylinder on the suction stroke does not immediately expand and fill the cylinder and prevent the full calculated quantity entering. It tends to keep its density in accordance with the carbureter regulation and then gives the engine more nearly the capacity of which a gas engine is capable.

In order to prevent the over-heating tendency immediately following shutting down an engine, it would seem necessary then to give the waterjacket such volume and distribution as to enable it to absorb the last head accumulations, independent of the circulating system. To this extent only does the jacket digress from the theory of the perfect chain set forth at the beginning of this discussion.

Jacket design therefore should be such as to allow liberal distribution of water and freedom of circulation. Since the circulating systems in general use are what may be classed as pressureless systems, the water will only follow the lines of least resistance within the cylinder. Short turns will at least materially resists circulation and may even prevent it and thus cause "steam pockets."

The design must be followed up by close inspection of the casting as it comes from the foundry. Too much stress cannot be laid upon this apparently obvious fact. The outside of a cored casting receives a lot of care and inspection to prove its freedom from flaws, but too often the inside is passed up as being hopelessly inaccessible to inspection and is assumed to be satisfactory if the exterior shows conclusively that there are no cracks.

## Circulating System

Between the pump system and the gravity system of circulation there is, at present, somewhat of a race for supremacy.

From what the writer has been able to observe the two systems appear to show faults that lie at opposite ends of the chart.

The pump system frequently over-circulates, or tends to, while the gravity system under-circulates. Both faults are conducive to trouble.

### Speed of Pump Varies with Motor Speed

In practically all pump systems the speed of the pump varies with the motor speed. This is logical enough and conforms with good engineering theory and practice. Rotary pumps must attain a certain minimum speed before they do any effective work. This means that the starting point is considerably above zero, say around 250 or 300 r.p.m. Then their efficiency increases after they get up to 500 r.p.m. and usually goes up on its curve to 800 or 900 r.p.m. The actual result is that when the motor runs at heating speed the pump, which was designed to do its circulating at a 20 car mile per speed, is working at high efficiency; the water is thrown up into the top of the cylinder and radiator tank faster than the internal friction of the radiator will allow it to return to the pump. The bottom of the radiator is thus one moment empty and the next full, or it may be simply allowing a small part of the water to pass into the pump and allowing a lot to be lost through the overflow pipes.

When the radiator is thus, in part, deprived of water, it is deprived of its chance to do the full amount of cooling of which it is capable. Over-heating or, at least, inefficient cooling results.

### Run Pump at Constant Speed

It would appear, then, that it might be well to select a pump speed designed to do its circulating within the limits of the radiator frictional resistance and then always run the pump at that one speed regardless of motor speed.

In marine work, where circulating pumps are used in connection with the steam condensers in exactly the same manner in which they are applied to automobiles, it was found that pumps had to be controlled independently of engine speed and such practice is now universal. It might prove worth the automobile engineer's time to investigate the experience of marine engineers along these lines.

The gravity system of circulation has been used with varying success. At best its impulse is feeble, due to the lack of head. On this account it succumbs readily to any abnormal frictional resistances that may result from solid matter in the water. It, of course, recommends itself because of its simplicity of construction, its low initial cost, its economy of operation and the advantages derived from the fact that it continues in operation for some time after the motor stops.

### Development of System in Its Infancy

Its practical application to the car, in a manner, to realize all those advantages is difficult. At present, too many of these systems are shaped in almost the same way that the pump system is shaped with pump omitted. Best results in gravity circulation as applied to the heating of dwellings and other buildings are obtained with the horizontal runs are comparatively short as compared with the head. The principle is identical in the automobile. The head pipe must always remain well submerged. This latter feature cannot be accomplished without the use of a reserve storage tank attached to the top of the radiator.

The practical development of the system is still in its infancy and it is out of the question to say at this date anything but words of encouragement to users of the system.

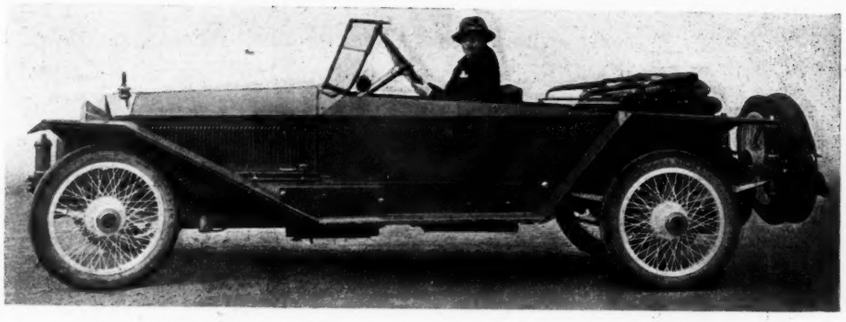
*(To be continued)*

# Three New Body Designs

## Futurist Body on Owen-Magnetic

*A SPECIAL body by Holbrook mounted on an Owen-Magnetic chassis is illustrated at the right. This body, which is very difficult to build because of the angular lines characterizing it throughout, was specially constructed for the 0-36 Owen chassis, the car, complete, costing $6,000.*

*The entire car is specially built, even the top irons, license holders, etc., being of angular design. The V-type windshield is matched by a top which comes to a point at the front.*



Futurist body by Holbrook mounted on Owen-Magnetic chassis

Anderson body convertible from five-passenger to two-passenger illustrated in both forms

## Anderson Convertible Roadster

*THE Anderson Motor Car Co., Rock Hill, S. C., is introducing an entirely novel type of body, illustrated at the left. This is instantly convertible from a five-passenger of full dimensions to a two-passenger, and when in two-passenger form there is practically no suggestion that the body differs in any way from a roomy roadster with a big rear baggage compartment. The front seats are divided, and in the five-passenger form the entrance to the rear compartment is between the front seats, since there are only two doors. There are no loose pieces or extra sections because the painted portion which forms the lid of the boot of the two-passenger is in reality the back of the seat in the five-passenger. The back seat itself and the vertical portion of the same both form panels of the two-passenger, being hinged together so that a simple pull causes them to roll up and become the deck of the two-passenger.*

*The most striking feature of this car is the simplicity of these moving parts and the absence of elaborate hooks or latches.*

## Hudson Four-Passenger Speedster

*THE four-passenger car illustrated at the right has been placed on the market by the Hudson Motor Car Co. This is mounted on the same chassis as the phaeton. In appearance the car is lower and longer than the Hudson touring car, 32 by 4½-in. wheels being used instead of 35-in.*

*Extra tires are carried on the rear of the speedster instead of on the running board. Some dimensions of the speedster are:*

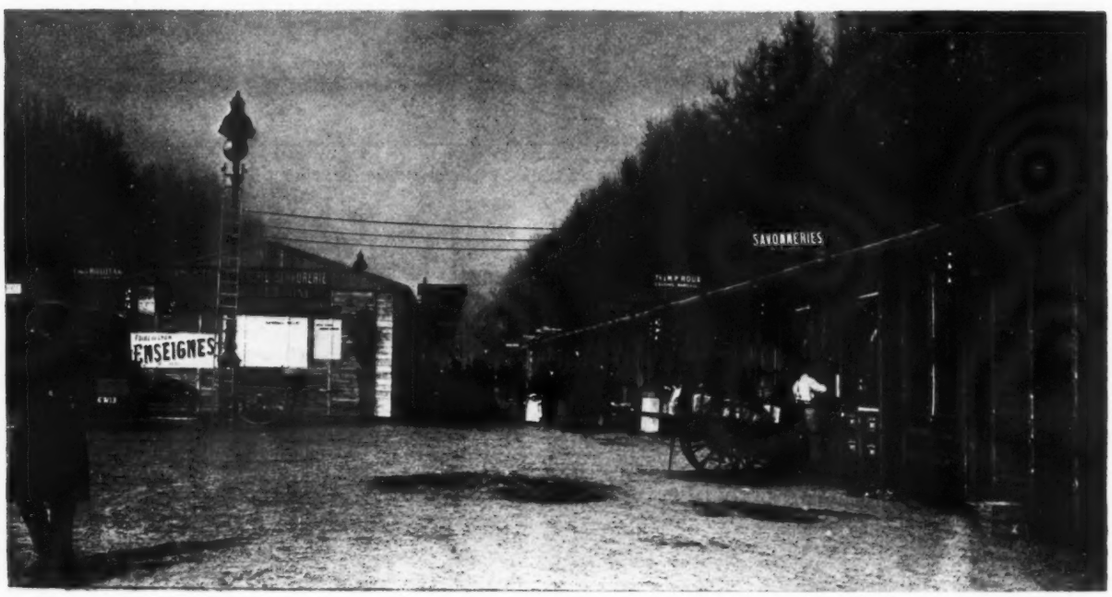
*Dash to front seat cushion, 30½ in.; front seat cushion above floor, 10½ in.; steering wheel above seat cushion, 7 in.; steering wheel to seat-back, 15 7/16 in.; back of front seat to front of rear seat, 28½ in.; rear seat above floor, 14¼ in.; front doors, 23 in. wide; rear doors, 18½ in.; height of body, 19¾ in.; length overall, 107⅞ in.; width of seat cushions, 41 in.*

New Hudson four-passenger speedster mounted on the same chassis as the phaeton

# U.S.A. Exhibits Prominent at Lyons Fair

## American Cars, Trucks and Accessories Well Represented—100 Exhibitors in Automobile Section—Crowds Visit Display

By W. F. Bradley




A section of the Lyons Trade Fair as it appeared on the opening day, March 20

LYONS, FRANCE, March 20—American automobile manufacturers have reason to be proud of the position they occupy in the Trade Fair which opened here to-day, with very little ceremony, after a postponement of a week, owing to weather conditions having upset traffic arrangements. Many of the stands were not finished, and a number of the American exhibits had failed to arrive, but this was due to the delays in transportation, and will be remedied in two or three days. The exhibition will remain open 15 days.

### 100 in Automobile Division

In the automobile section there are exactly 100 exhibitors, though some of these occupy several stands and many of the agents represent several firms. Right at the head of this section is the official American stand, where Consul John E. Jones has on hand a big selection of catalogs and samples, and is kept busy all day answering inquiries from would-be purchasers. American cars and trucks to be found in the fair comprise Maxwell, Overland, Federal, United, Detroiter, Scripps-Booth, Pullman, Haynes, Hudson and Sterling. In addition, Bowser, Goodrich and Goodyear have big stands. Other American automobile manufacturers are represented by Gaston, Williams & Wigmore and the Butterosi Syndicate, but do not have cars or trucks on exhibit.

### No British Exhibits

The attitude of the French automobile trade toward the fair is somewhat peculiar. The Chambre Syndicale de l'Automobile, the most important manufacturers' association in France, sent out a semi-official intimation that automobiles were not to be shown at the Lyons fair. Evidently this was done with a view to removing any possible competitor to the Paris Automobile Salon, intended to be re-established after the war. This notice was sent to British makers, who evidently took it to heart, for not a single English automobile, motorcycle or cycle is represented at the exhibition. The French makers, however, have appreciated this piece of advice at its true value, the only absentees who could have been present being the half dozen firms constituting the main props of the Chambre Syndicale.

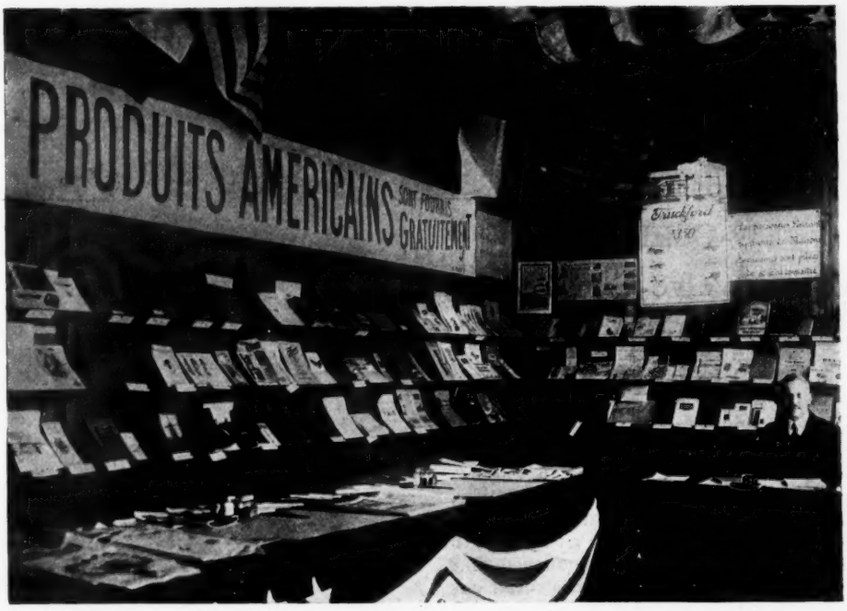
### Lyons Fully Represented

Lyons, which ranks second to Paris in automobile manufacturing importance, is represented by all its car makers, namely, Berliet, Rochet-Schneider, Cottin & Desgouttes, La Buire, Luc-Court, Barron-Vialle, and the Zenith Carburetter Co., whose home factory is in this town. Other European firms taking part in the fair are Peugeot, Piccard-Pictet, Th. Schneider, Turcat-Mery, Le Zebre, Unic, Fiat, Isotta-Fraschini, Moto-Aratrice, Rolland-Pilain, Saurer, Sigma, Delaunay-Belleville, Spa and Alda. Manufacturers of components, such as axles, steering gears, ball bearings, magnetos, plugs, etc., form an important section of the automobile and general engineering departments.

### Not a Show

The Lyons Fair is not a show in the sense of the Paris automobile salon or the New York automobile show. The participants are housed in temporary wood offices, just sufficiently big for the purpose and built without any view to decorative effect, on the banks of the Rhone and Saone, in the heart of the city. There are about 6 miles of these

stands. There is nothing to attract the retail buyer and no attempt is made to secure his presence. The committee responsible for the fair frankly avow that they are out to smash the Leipzig fair and make Lyons the trade mart of the continent of Europe. The first exhibition opened last year with 790 exhibitors. This year there are 2320 stands, with a greater number of firms represented, for some dealers represent three or four manufacturers. The Leipzig fair had 1300 exhibitors in 1897 and had risen to 3700 in 1910, so that the rate of progress of the French fair is very much greater than that of the German rival. It is claimed that last year business was transacted to the value of $10,000,000, and that another $8,000,000 worth of business had to be refused owing to the inability of the firms to execute orders.

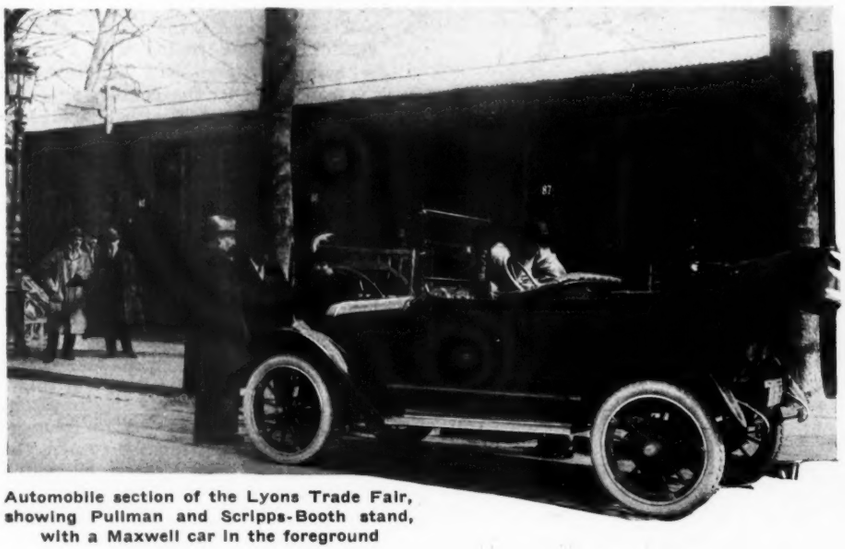



A corner of the official American stand where Consul Jones has a large selection of catalogs and samples and is busy all day answering inquiries regarding U. S. A. cars, trucks and other products

At this writing it is too early to say what will be the practical result of the 1917 fair. But in spite of very restricted railroad facilities and very severe weather, which has already made it necessary to postpone the opening for one week, and has delayed the completion of some of the stands, Lyons is so crowded with buyers and sellers that it is difficult to find accommodation at the hotels. Lyons has a population of more than 700,000, and the organizing committee has made adequate arrangements for the lodging of a large number of visitors in private houses. Also by a direct appeal to the intelligence of the hotel proprietors and restaurants it has succeeded, so far, in preventing any boosting of prices.

**Fair Well Managed**

The fair is extensively advertised, is well managed in every respect, and is a striking example of the industrial and commercial revival of France and of the determination of that nation to succeed in the trade war which will follow the present clash of arms. Both allied and neutral nations are being attracted to Lyons and given exactly the same facilities as the home manufacturers, but no enemy goods of any kind are allowed to be brought in. By reason of its geographical situation, within easy reach of all parts of France, of Italy, Switzerland and Spain, Lyons holds all the advantages. It is a pity, therefore, that both Paris and Bordeaux have thought it necessary to hold an annual fair. There is considerable local feeling against the action of these two cities, for the competition is certainly unnecessary.



Automobile section of the Lyons Trade Fair, showing Pullman and Scripps-Booth stand, with a Maxwell car in the foreground

## War Aids German Automobile Industry

PROSPERITY has come to the automobile industry in Germany as a result of the war, according to the financial columns of the *Frankfurter Zeitung*. The Oberursel Motorenfabrik, maker of aeroplane and automobile rotary motors, has shown the greatest gain in wealth in the industry since August, 1914. This company paid a dividend of 35 per cent in 1915. It is increasing its capital from 2,500,000 marks to 4,500,000 marks (approximately $595,000 to $1,071,000), and yet expects to pay about the same dividend for the current year.

There are six large motor companies in Germany, namely: Adlerwerke, Frankfort-on-Main; Benz & Co., Mannheim; Daimler Motorengesellschaft, Stuttgart; Duerkoppwerke, Bielefeld; Fahrzeugfabrik, Eisenach, and the Oberursel plant at Oberursel, a suburb of Frankfort. The net profits of these companies rose from 14,063,571 marks, or $3,347,130, in 1913, to 31,417,192 marks, or $7,477,292, in 1915. The average dividend rose from 12.6 to 25.3 per cent.

These figures should be accepted, however, with a certain degree of caution. Although in terms of money the dividends have increased and the profits grown, the added purchasing power has not been so large.

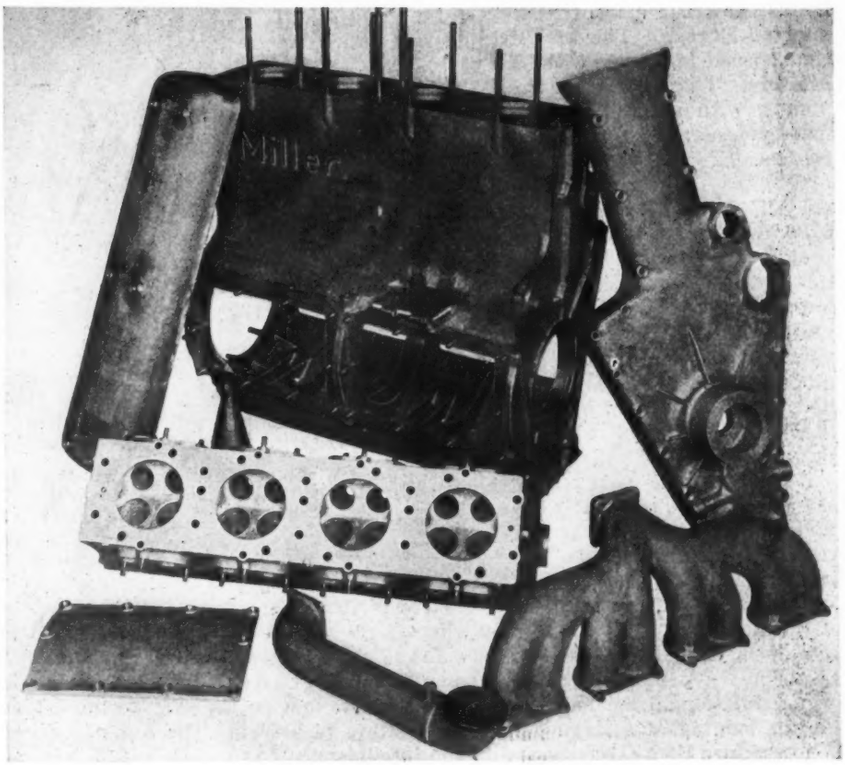
# Miller Racing Engine on Test

## Develops 135 Hp. from 289-Cu. In. Four —Twelve-Cylinder Under Construction

A GOOD deal has been heard about the racing and aviation engines being built by Harry A. Miller, Los Angeles, Cal., one of the pioneers in modern aluminum science as applied to automobiles. It is now announced that the four-cylinder model has proved excellent on the test block, and the twelve is nearly ready for trial.

The four, which was intended for use in racing this year, is 3⅝ by 7 in., or 289 cu. in. piston displacement, and it is stated that a water brake reading showed 135 hp. at 2950. This is equivalent to 1 hp. per 2.14 cu. in., which is a very commendable performance. The weight is given as 450 lb., including one carbureter and two magnetos, or just over 3.3 lb. per horsepower.

The main body of the engine without the detachable head is one casting of the Miller aluminum alloy, "alloyanum," and comprises the barrel type crankcase, sump and cylinder water jackets, thereby making for extreme rigidity and strength. The cylinders themselves are sleeves of cast vanadium iron 5/36 in. thick, machined throughout and having a flange at the top. They are dropped into place in the water jacket, where an ingenious packing device makes the joints watertight.



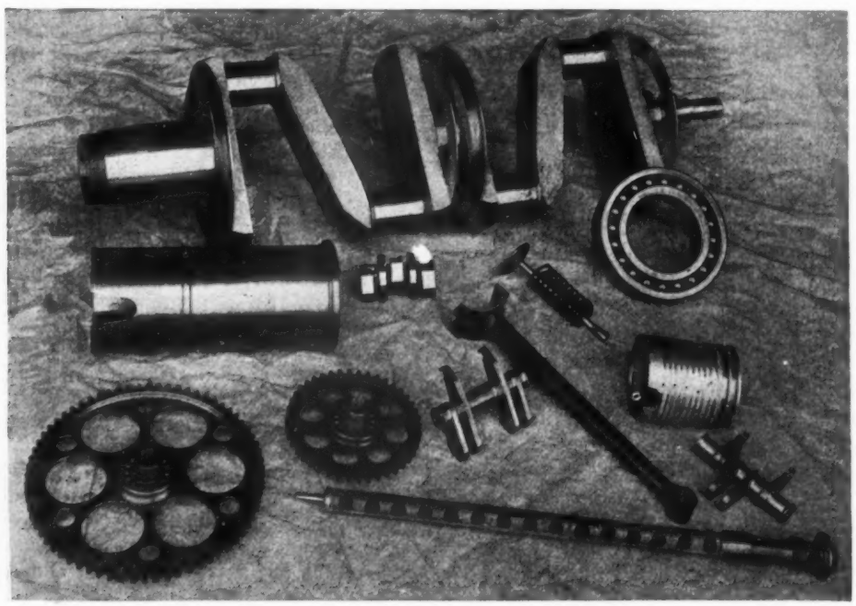

Some of the aluminum parts of Miller four

An important feature of this type of cylinder and jacket construction is the fact that it permits the use of larger cylinder sleeves up to a size of 4¼ in. in the same engine casting, the only result of this increased size being to slightly diminish the water space, which is more than ample.

Actual contact of iron and aluminum is reduced practically to a minimum, and consequently the water is brought into direct contact with almost the entire outer surface of the iron cylinders themselves. This results in a very high cooling efficiency.

The two-piece crankshaft of chrome vanadium, heat-treated steel runs on four large sets of ball bearings, one in front, one in the center, and two at the flywheel end, with oil rings to take care of lubrication. A train of five spur gears, each mounted on a double row of ball bearings, drives the overhead camshaft, and these are inclosed in an oiltight case with quick detachable cover. The camshaft, hollow and very light, has five ball bearings which make allowance for even the slightest distortion, and a constant feed of oil at pressure in the shaft lubricates the action at each cam, filling a sump into which the cams dip.

The cam unit deserves special attention in that there are extra follower cams which mechanically return the forked rocker arms, each of which operates two valves. This makes the rocker positive in its return, independent of the spring action.



Parts of Miller engine. Observe the cam unit made separate from the camshaft

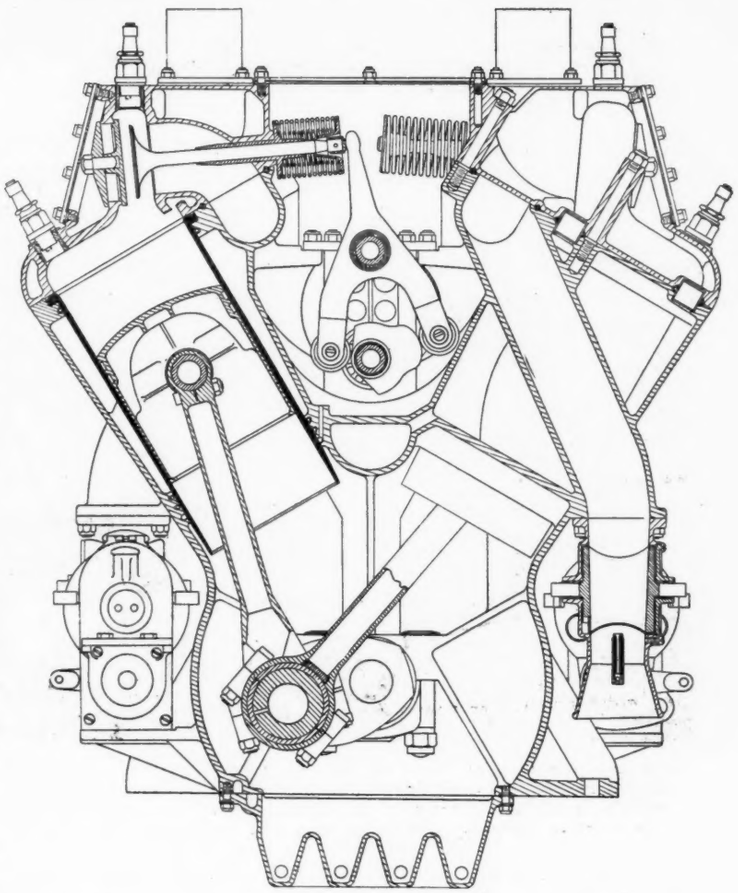
The valves, sixteen in number, have their seat directly in the aluminum of the cylinder head casting and are placed at an angle of 30 deg., the exhaust being 1 9/16 in. in diameter and the intake 2 in., all valves having a seat 1/16 in. wide and a lift of ⅜ in.

The alloyanum pistons weigh 1 lb. 2 oz. each, and are well ribbed for strength and heat radiation. They provide their own bearing for the wrist pin, and carry two rings each of the Miller concentric type. Connecting-rods are of tubular design and taper for maximum strength and minimum weight. They are chrome vanadium forgings machined throughout and carefully heat treated, with four bolts at the big end clamping in place the babbit-lined bronzes that make up the bearing. At the small end, which is split, a single bolt holds fast the wrist pin and also keys it in position. The entire rod and piston assembly can be put into the engine with the crankshaft in place or removed therefrom through large hand holes.

A centrifugal pump placed at the front end of the crankshaft puts water directly into the jacket without manifold or piping, whence it is distributed into the head through large, well-spaced openings, guarded with individual ring gaskets set in sunken grooves. A double gear oil pump is located in the sump, one half feeding the oil to every point, while the other drains the used oil from the sump through a screen and delivers it back to the outside supply tank. In or about the motor itself there is not a single piece of oil tubing.

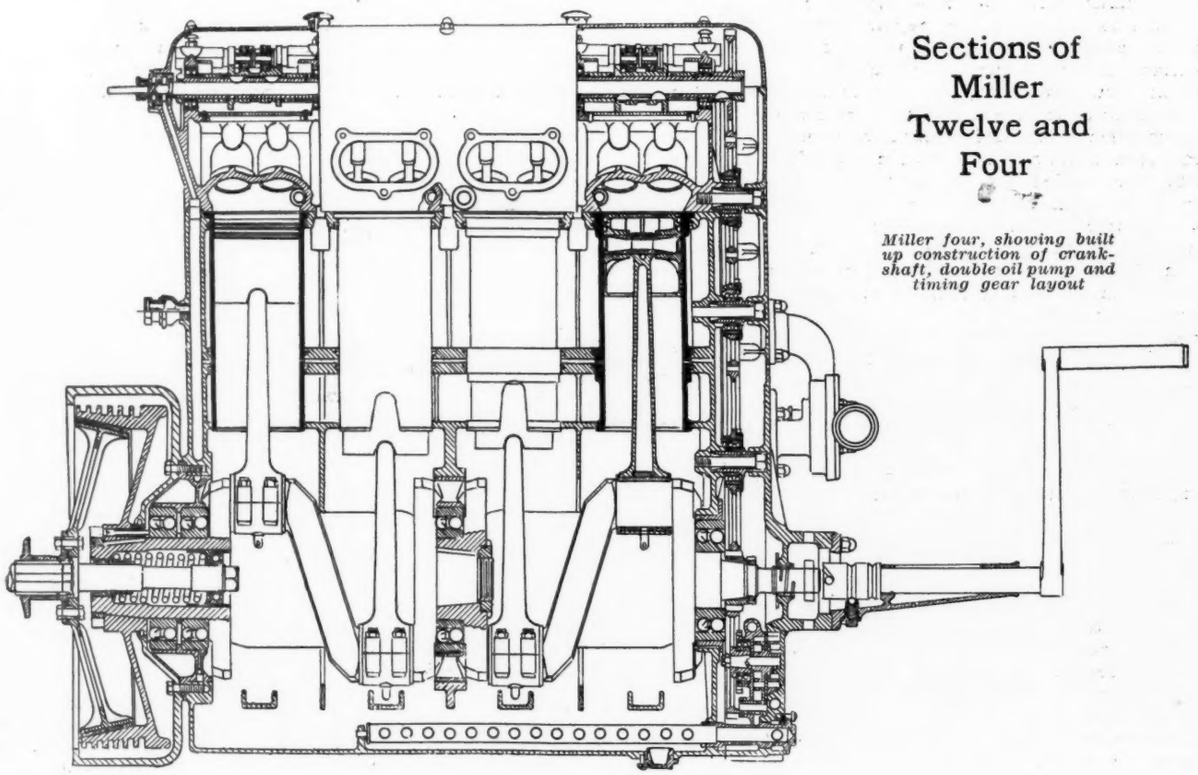
Ignition is taken care of by two Bosch magnetos placed one on either side of the engine, driven from the first idler gear, each one firing a set of plugs placed in the head. The carbureter is a Miller multiple jet type.

For aeronautical purposes a two to one reduction gear of very simple construction is mounted on the crankcase, displacing the flywheel. This gear is designed to carry the propeller in direct line with the shaft, with all parts mounted on ball bearings. A very large ball thrust takes care of all end stress.



*This transverse section of the Miller twelve now being built shows the double rocker construction which operates the tappet positively, leaving the valve alone to be seated by the spring*

## Sections of Miller Twelve and Four

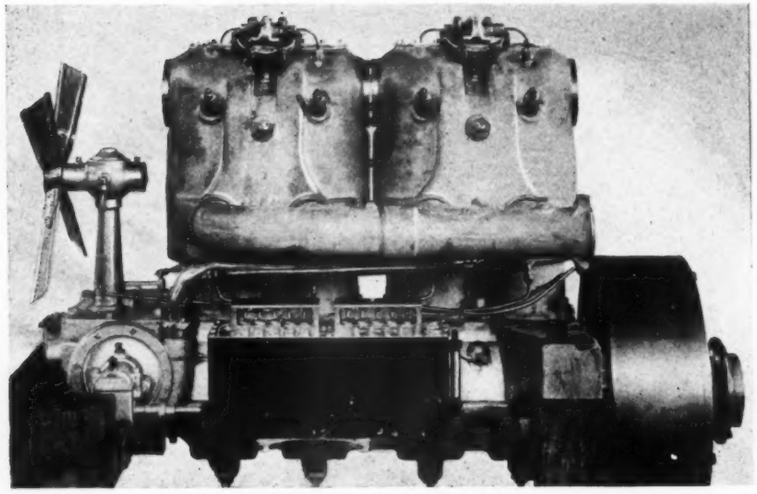


*Miller four, showing built up construction of crankshaft, double oil pump and timing gear layout*

AUTOMOBILE

# Williams Engine Is Two-Cycle Design

## New Construction for Automobile, Truck, Aero and Marine Use Will Throttle to 100 R.P.M.—Liquid Gasoline Pumped into Combustion Chamber



Williams cylinder heads with two-cycle principle fitted to an Amplex four-cylinder engine. It will be noted that fuel injector pumps are opposite each other and at an angle instead of vertical over each cylinder as shown in the descriptive diagrams. The latter type will be used in stock engines

A TWO-CYCLE engine which will throttle to 100 r.p.m. will be manufactured by the Williams Motors Co., Waukegan, Ill. An unusual feature is that liquid gasoline is pumped into the combustion chamber where it mixes with air coming under pressure from the crankcase. One of the difficulties with two-cycle engines for automobile use in the past has been to secure regular firing at low crankshaft speeds. Because of its ability to idle at such low speeds the Williams motor is claimed to be suitable not only for automobile and truck work, but also for aviation and marine uses.

Pumping of the liquid fuel into the combustion chambers is obtained without any gears or other mechanical means. It is done by a double piston valve which lies horizontally over the tops of two cylinders, one valve unit doing for two cylinders. This valve slides back and forth, due to the compression and exhausting in the cylinders. When one cylinder is compressing the valve is moved in one direction, and when the other cylinder of the pair is compressing it is moved in the opposite direction.

Fig. 1 is a diagrammatic illustration of two cylinders in the Williams four-cylinder engine. The exhaust port is shown uncovered by the piston, being at the bottom of the stroke in the cylinder at the right in each group. There is also an auxiliary exhaust through the valve in the cylinder head as indicated in part *B*, at *P* 1.

The left cylinder in part *B* shows pure air entering a port at the left side of cylinder 3, while the piston is at the top and so entering the crankcase, where it is compressed and thence by-passed up the side of the cylinder to the combustion chamber as in cylinder 4.

The single reciprocating valve in the top of each cylinder pair resembles two pistons joined together by a rod. This double valve slides back and forth by air-pressure conditions, and as it moves back and forth it operates a couple of gasoline pumps which in turn inject the gasoline into the cylinders. The position of these pumps is indicated in Fig. 2.

Fig. 2 shows more clearly how the sliding valve pumps the gasoline through the tapered sides of the cam surfaces forming part of the valve pistons. When the valve makes a stroke one of the tapers causes a roller to lift and this roller operates the pulsometer fuel injector, which is shown in Fig. 4.

On the conventional four-cycle engine, exhaust will open shortly before bottom dead center and remain open until top center for over 200 deg. crank travel. The burned gases are driven out so that, roughly speaking, only a volume equal to the compression space remains, and really, due to the inertia of the gases, even less.

On the conventional two-cycle engine, the exhaust ports open before bottom center and remain open to an equal distance after bottom center, so that a volume of burned gas equal to the compression space plus three-fourths of the stroke remain. This being mixed with the new charge gives a low-grade mixture which is especially noticeable when throttling down, and this is why conventional two-cycles idle poorly.

It is the automatic piston valve in the Williams engine which obviates this trouble. The valve is operated by the pressures existing in the two cylinders, which are connected by cranks 180 deg. apart. The tops of the two cylinders are connected by an auxiliary cylinder in which floats the pneumatic piston valve. This valve is moved alternately by the compression pressure of the two cylinders as stated.

Between 50 and 60 deg. before the bottom dead center, the right cylinder has the same pressure as the left cylinder, which is at 300 to 310 deg. after bottom center. Therefore the pneumatic valve is in what might be called a neutral

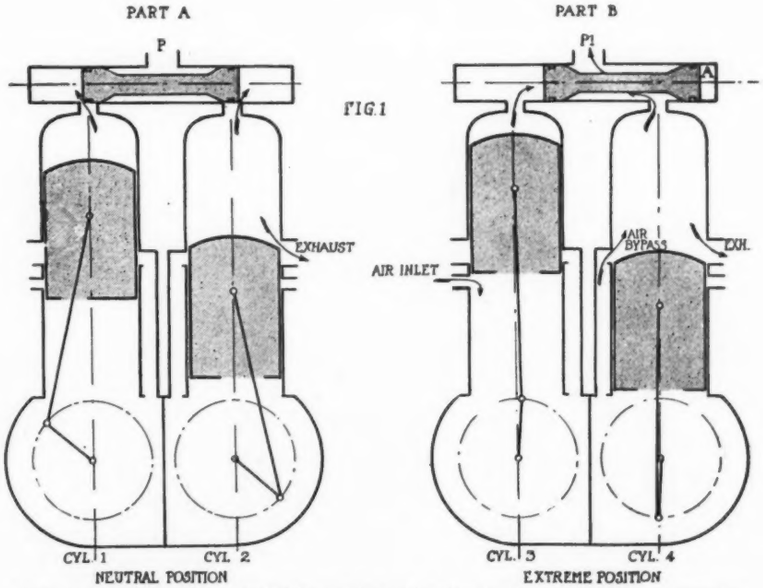



Fig. 1—Diagrammatic illustration of two cylinders in the Williams four-cylinder engine. The exhaust port is shown uncovered by the piston, being at the bottom of the stroke and the cylinder at the right in each group

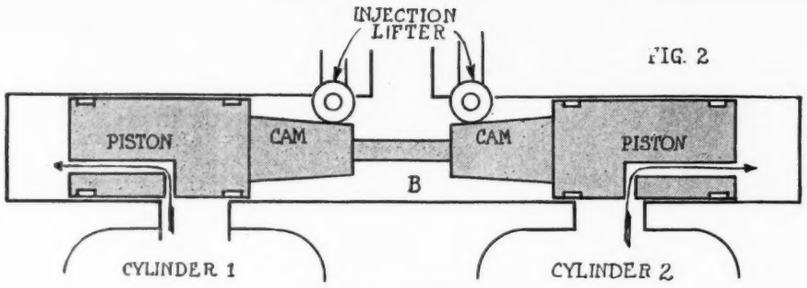



FIG. 2

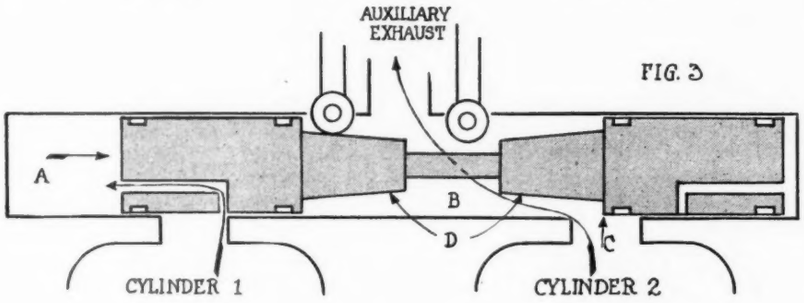



FIG. 3

Above—Fig. 2—Illustrating how the sliding valve pumps the gasoline into the cylinders of the Williams engine through the tapered sides of the cam surfaces which form part of the valve pistons

Below—Fig. 3—An auxiliary exhaust valve permits of letting gases out of the engine for throttling down

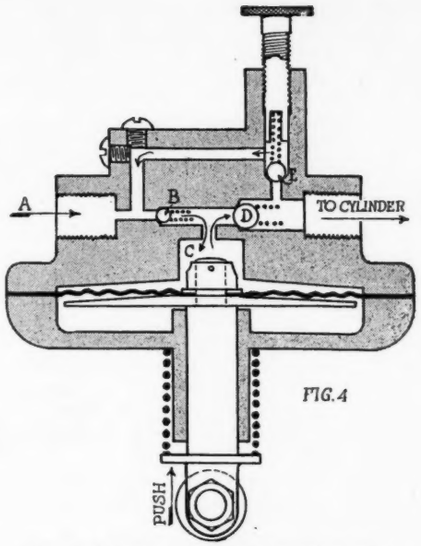



FIG. 4

Fig. 4—Injector of the pulsometer principle used in the Williams engine. The amount of fuel supplied is regulated by the area of the diaphragm and the length of the stroke. Pressure can be regulated by changing the tension on the spring E and any over amount of pressure will be sent back to the inlet through the by-pass above E

position, see part *A*, Fig. 1. The left cylinder, increasing in pressure, will start to drive the pneumatic valve toward the right, thereby closing up the port in the right cylinder, which encases fuel gases in compression space *A*, as shown in Fig. 1, part *B*.

The more the pressure in the right cylinder increases, the more the pneumatic will work to the right, thereby increasing the incased pressure in *A*, the tendency being to keep both sides of equal pressure and the result is that the gas chamber, which has the least pressure, forms a pneumatic stop for the valve.

The extreme end of the stroke of the piston valve will be at the time of maximum explosion pressure, roughly speaking, about 10 to 15 deg. after top stroke. Then the pressure decreases and the gases in the pneumatic cushion expand, thereby moving the piston valve back until the pressure on both sides is equal again. After this the same operation is repeated.

If the port were to be left as wide open as the sketch in Fig. 1 shows, the speed of the pneumatic piston would be so great that the pneumatic cushion would not stop it, since some of the gas in the pneumatic cushion would escape through the big opening. To obviate this the gases pass through the small holes indicated in Fig. 2, by the arrows, and the gas can only communicate from the cylinder to the pneumatic chamber through these small holes where resistance is offered to the gases against their returning to the cylinder and a small amount of gas is taken to drive the piston. The speed of the gas through these small holes has increased to such great proportions that no carbon can deposit in them.

### Carbon Deposits Impossible

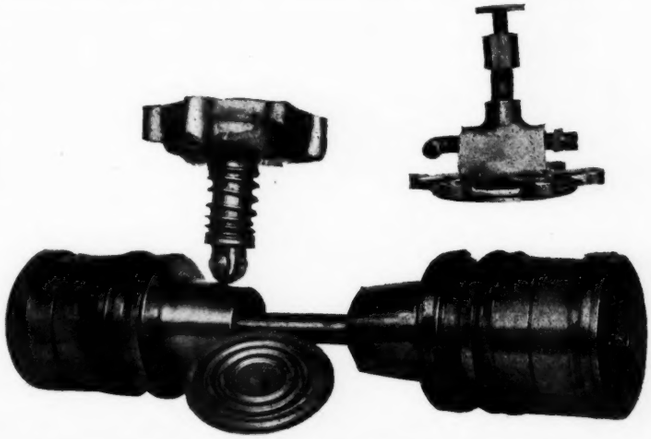
Furthermore deposit of carbon in the pneumatic compression space is impossible, as this pneumatic chamber is never exposed to the cylinder directly during the explosion time. As this pneumatic chamber can never have any carbon deposit, its volume cannot be changed, therefore the speed or length of stroke of the pneumatic is constant.

The space *B*, as shown in Fig. 3, will contain gases coming from the cylinder, and if one desires to throttle down, those gases can be let out through an auxiliary exhaust valve when the point *C* is over the port; the period ranging from 50 to 60 deg. before bottom center until 120 to 130 deg. after bottom center. The gas can be let out to any amount desired during that time, thus throttling the engine by reducing the piston valve travel, and after that time the neutral position is reached again and the two ports are closed.

At the conclusion of this operation the fuel is thrown in. There is a pair of cams built as shoulders to the two ends of the pneumatic piston, as shown in Fig. 3. Inasmuch as the piston floats, and thus can oscillate, these circular-tapered cams present a very large wearing surface to the rollers which they operate.

The roller operates a diaphram which will be described later. As at low speed the maximum pressure of the engine is lower, the stroke of the pneumatic is bound to be shorter and through this the lift of the fuel injectors, which are the diaphragms, will be smaller, giving a smaller amount of gasoline to be injected into the cylinders.

The injector is of the pulsometer principle, the gasoline getting into the injector through *A* in Fig. 4, passing the check valve *B* and entering chamber *C*. Then, through the movement of the diaphragm in the direction indicated, it will increase the pressure on the fuel and drive it through the check



All parts required for injecting and exhausting gases in Williams engine. The piston traveling back and forth over the top of two cylinders operates diaphragm plunger by means of the tapered skirts. At the upper right is the diaphragm head with this adjustment and in front of the piston is the diaphragm

valve *D* to the cylinder. The amount of fuel supplied is regulated by the area of the diaphragm and the length of its stroke. The pressure can be regulated by changing the tension on spring *E* and any over amount of pressure will be sent back to the inlet through the by-pass above *E*. As there is no movable packing such as a plunger would require this arrangement has little to get out of order or wear out.

In comparison with the four-cycle type of engine there are few working parts. The Williams design eliminates the need for valves, springs, lifters, camshafts and all complications of the crankshaft through the camshaft and its gears. In the Williams block the pneumatic valve-carrying cylinder is cast integral with the block, and its machining requires a boring sweep only. The ends of the compression spaces on each end of the pneumatic piston are sealed by caps which are bolted direct to the casting.

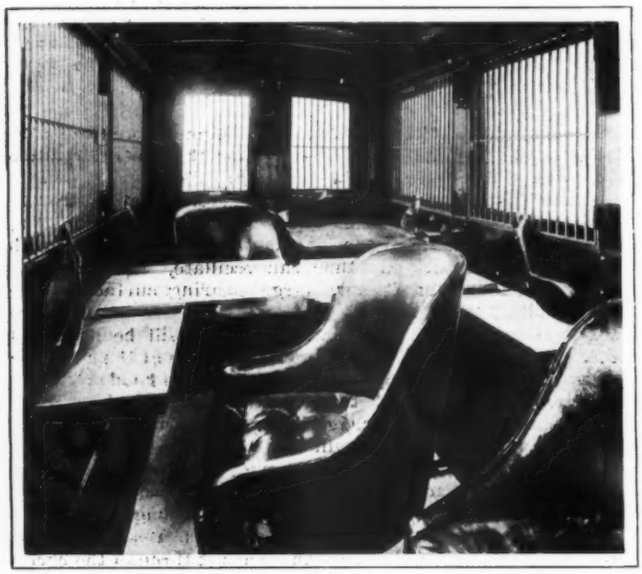
For removal and inspection of the valve the work necessary is simple. The entire fuel injector may be pulled out by removing several cap screws. Then the caps on the end of the pneumatic cylinder may be quickly removed and the valve pushed out.

Preparations are under way for initial production of marine engines and the manufacture will be of a broader scope later, including the construction of aviation and automobile engines. Experimental work has been going on in the present factory for nearly a year.

## Measuring Compression

INQUIRERS are often advised that a frequent cause of failure to deliver power is faulty compression or lack of compression, due to leaky piston rings and that the way to detect leaks is to listen while the engine is turned over. I have never seen any instrument sold for measuring compression, but I have a home-made one that serves the purpose perfectly and can be made for 10 cents or less. Take a worn-out spark plug, remove the porcelain and keep only the metal shell. Take the stem from an old inner tube, cut off the lower part and fit the upper part into the base of spark plug, reaming the latter or filing the former to make a fair fit, then solder them together. Remove all the spark plugs, screw the combination into one spark-plug hole and have someone turn the engine over quickly while you hold a tire gage on the stem. It will show the compression. By trying this on a new car, you can see just how your compression compares.

# Motor Truck Carries Complete Paymaster's Office



Interior of White truck used as paymaster's office by Chicago Surface Railway Lines

A WHITE truck with a specially designed body containing all the conveniences of an office and protected against highway bandits is used by the Chicago Surface Railway Lines to carry the pay envelopes of thousands of its employes to car barns and other widely scattered districts.

In some cases the truck merely transports paymasters and large sums of money from one car barn to another. In others, trips of several miles are made into the country to pay off line and track men and gangs engaged in special construction work such as the building of new bridges, tunnels, buildings and general track improvements.

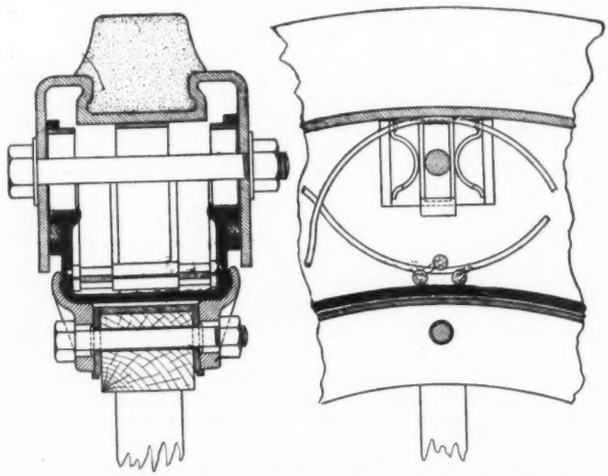
The truck has accommodations for four paymasters, a chauffeur and a guard, all of whom go heavily armed. The paymasters are provided with swivel chairs and work at tables which hang on hinges and may be dropped down when not in use. The table in the center of the office, as shown in the accompanying photograph, is used for making up payrolls while the truck is enroute and within easy reach on either side are shelves for money trays. The windows are protected by iron bars and connected with an alarm system.

In paying direct from the truck the chief paymaster sits at the extreme end of the office, takes the pay envelopes from the shelf and passes them out to the workmen through a wicket in a window on his left. While the men are receiving their money the guard stands on duty in the rear of the office and the chauffeur guards the front. When the truck is traveling through the streets all money and other valuables are carried in a special steel vault built in the body of the truck behind the rear seat.

## McKeag Resilient Rim

ILLUSTRATED herewith is a resilient rim and tire combined for passenger cars and commercial vehicles. This wheel was invented by H. McKeag, of New York, with the idea of rendering pneumatic tires unnecessary. It consists of an inner and outer shell of pressed steel, between which is a series of highly tempered flat strips of steel of serpentine formation, each steel strip going completely around the wheel and riding on the inner rim or shell of the tire between a series of case hardened rollers. The steel strips have a free motion within a limited space and are kept in place by the rollers through which they pass. The rollers are kept in position by the serpentine strips of steel.

The tires are designed to keep out water and dirt and to use either a steel tread, steel studded, waterproof fabric, or one of solid rubber.



McKeag resilient rim designed to replace the pneumatic tire

This illustration gives some idea of the difficult conditions under which trucks are obliged to operate on the Italian front

# Successful Army Trucks

## Part II

## Italian Front Presents Most Varied Conditions of All War Theaters—Staff Car Service Is Highly Organized

By W. F. Bradley

*EDITOR'S NOTE: This keenly analytical article reflects the comprehensive observations of Mr. Bradley, special representative of THE AUTOMOBILE with the allied armies, on the mechanical features of trucks and cars in Italian army service, with comments on their practical value.*

WITH a front stretching from the snow-capped Stelvio, near the Swiss frontier, to the sun-scorched plains at the head of the Adriatic, Italian war conditions are the most varied, the most difficult and the most picturesque in Europe. At the Swiss end of the line troops operate among eternal snow more than 12,000 ft. above sea level; at the head of the Adriatic they hold the barren, rocky sun-scorched Carso plateau, only about 300 ft. above the sea, with a big stretch of level, monotonous, captured territory in their rear. Between these two points there are extremes of climate and natural conditions as great as are to be found in the whole of the United States; yet the length of the front is not equal to the length of the Atlantic seaboard between Boston and Wilmington, N. C.

### Uniformity Is Impossible

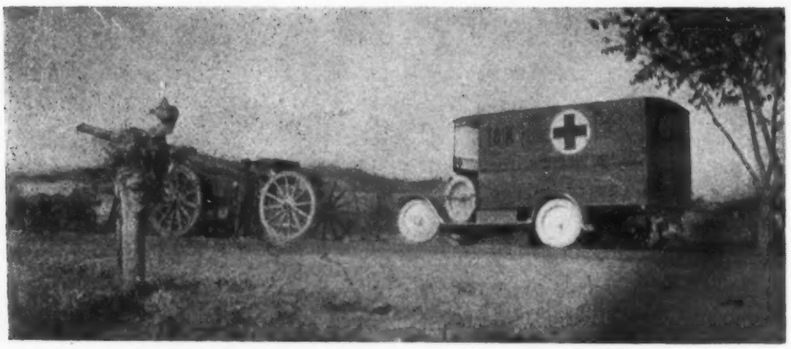
These exceptional natural conditions make the transport services of the Italian army quite different from those of any other of the Allied powers. Obviously, there cannot be uniformity. Indeed, the first impression of any stranger visiting the Italian front is the—judged by American standards—wonderful juxtaposition of ancient and modern. The century-old farms of sunny Friule, which had never been desecrated by steam, where gasoline was an unknown odor, and which are still innocent of American agricultural machinery, have been invaded by a modern army with all the perfections of science and industry. Thus side by side with lazy ox-teams and wagons which ought to fall to pieces, but never do, may be found modern gasoline tractors hauling 20-ton loads and wonderful armored cars having a speed and gun capacity undreamed of until after the war cloud burst.

On the road are to be met mule columns, each animal carrying a truss of hay, a single wood beam or a leaky canvas water bag; they are followed by a modern automobile munition column; Sicilian mule carts with scenes from the lives of the saints painted on their panels are overtaken by speedy and luxurious staff cars; 50-mile an hour armored cars make dashes into vulnerable parts of the enemy's lines; troops on the march are followed by light, almost flimsy baggage carts drawn by one or a pair of horses; at one point wounded are brought away individually on the backs of mules; at another place the work is done by the most luxurious automobile ambulances the world's automobile industry can produce.

This combination of the finest mechanical and the most primitive animal and human methods of traction is almost inevitable on such a front as that held by the Italian armies. Without gasoline it would be impossible to carry on the war on a fraction of its present scale; yet there are sections of the front which have and probably always will remain closed to gasoline vehicles. Half a dozen of us, with an hour's time to kill in an advanced post, tried to imagine the war in Italy without the gasoline motor. We reduced it to an affair of outposts occupying a few hundred men—then gave it up as impossible.

### The Greatest Difficulties Are on Lower Heights

Contrary to what may be expected at first sight, the greatest automobile difficulties are not encountered on the high peaks but on the lower heights, such as the



An ambulance and a big gun on their way to the Italian front

Middle Isonzo district and the Carso. The main roads on the higher passes are wonderful examples of engineering, and although convoys may have to climb steadily for 6, 10, 12 or more miles, it is not often that the gradient gets above 7 per cent, while a 12 per cent gradient is almost an exception. The main roads on the higher passes are all macadam surfaced, scientifically drained, and as the traffic is never heavy, they can be kept in good condition. Nevertheless, an abrupt climb from sea level to 4000 ft., practically all on the lower gears, and with full load aboard, is a much more strenuous test than a few hundred yards on a freak hill. The descent is almost as strenuous, for brakes have to be used constantly, and hairpin bends on sharp gradients call for an efficient lock and skilled handling.

**Traffic Congestion Frequent**

On the lower heights—from 600 to 2000 ft. above sea level—masses of troops can be operated and road traffic naturally increases in intensity. In some of this wild, hilly country, with gradients varying from 5 to 10 per cent, there is as much vehicular traffic as will be found any day on upper Broadway, New York. Cut out of the face of the hill, it is difficult to make these roads wide, except at a great expenditure of time and labor, and as they are always under shell fire, they cannot be kept in good repair. Holes can be filled up and stones can be scattered, but to properly macadamize them is out of the question. It is with such a combination—roads just wide enough for two vehicles, with an abrupt wall on one side and a clear drop on the other; a rough surface several inches deep in mud, frequent shell holes and intense traffic, that the greatest strain is put on the automobile service.

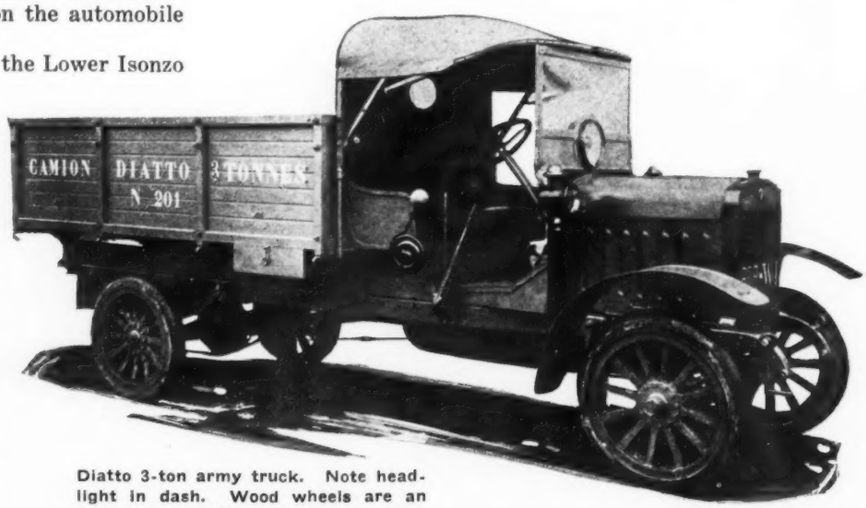
To give a specific instance, there is on the Lower Isonzo front a route 10 miles long uniting two important points and carrying very heavy traffic both day and night. The maximum gradient is 8 per cent, and for a distance of 5 miles never drops below 4 per cent. The entire road is under shell fire, and in consequence only roughly repaired by hand labor—it is never steam-rolled. During wet weather there may be 6 in. of mud on the road; from time to time, as shells fall, there are holes of much greater depth, but they are rapidly filled up by throwing in whatever material is available. Under winter conditions this road presents the maximum of difficulties truck convoys can encounter and maintain a regular service. That is to say, if conditions were any worse convoys would not get across regularly, although isolated vehicles, cleverly handled, would undoubtedly make the trip. Convoys of 1-ton Buicks, with their normal load, and handled by experienced men, can just make this trip, but a considerable amount of bottom gear has to be used, and generally the radiator needs replenishing at the end of the run.

**Tractors Haul Big Guns on Heights**

The statement that the most strenuous conditions are not encountered on the highest mountain roads may come as a surprise to persons unacquainted with European roads. It must be remembered, however, that the higher the mountains the smaller the traffic, and also that these roads are beautiful examples of engineering and have for years been kept in perfect condition. On the higher passes there is but a small use of infantry, everything depending on the artillery. Gasoline tractors are generally employed to haul the guns into their positions, but it is very often possible, and indeed most economical, to send supplies of ammunition up by means of an aerial cable. This is more rapid and less costly than road transport; it leaves the highways free for other traffic, and, of course, lengthens their life.

These Alpine roads are narrow of necessity, both cost and natural difficulties operating against anything wider than is necessary for two vehicles abreast. Passing is a very difficult matter on the numerous bends. On this account traffic control plays a most important part. Because of the greater danger, the volume of traffic which can be carried is very much lower than on the roads of equal width in the plains. It is most important, too, that these roads should not be overcrowded, for a single disabled vehicle on a bend can hold up all traffic in both directions. The urgent necessity of keeping animal and mechanical traction separated as much as possible is obvious in these mountain districts. It is rare for an automobile to suddenly refuse to take a certain gradient; but when this does happen the driver has warning that his motor is failing and can either pull in to one side or run back so as not to interfere with passage.

It is a very frequent occurrence for horse and mule teams to be unable to climb gradients which automobiles will take with ease. When a horse team balks on a hill,




Diatto 3-ton army truck. Note headlight in dash. Wood wheels are an exception. Radiator has no guard. This is a defect

the animals always get more or less out of control, and unless skilfully handled the teams will run backward, sometimes going over the edge of the road, it may be to a drop of several hundred feet.

One of the peculiarities of the staff-car work on the Italian front is the comparatively small size of the engines employed. One of the biggest cars used for this service is the 20-30-hp. Lancia, which has a four-cylinder motor of 3.9 by 5.1-in. bore and stroke. Fiat has also in use a large number of staff cars of the same rated horsepower and cylinder bore, but with a 5.5-in. stroke. There are, however, in general service a very large number of five-seated staff cars with four-cylinder motors of only 3.1 by 5.5-in. bore and stroke, as well as 12-hp. Fiats of only 2.7 by 4.7-in. bore and stroke. These small cars seem to do their work remarkably well, both on the rough, heavy roads of the lower Alps and on the higher mountains.

1½ and 2½ ton Fiat trucks waiting orders to move forward to front line positions

### Six-Cylinder Engines Rare

Six-cylinder motors are rare, while eights and twelves are altogether unknown in Italian service. Practically all these cars have a track of 55 in. and a wheelbase of 110, but not often exceeding 118 in. Undoubtedly these medium-size cars are more advantageous on narrow and crowded mountain roads than larger models, for they get through traffic easily and enable a higher average speed to be maintained than would be possible with a bigger machine. Italian officers, too, appear to be less inclined to ostentation in the matter of automobiles than is the case among some of their Allies. Despite the extremes of climate, open touring cars are in a great majority. Several cases of generals of divisions could be mentioned who are quite satisfied with a 15-20-hp. Fiat touring car for all-year-round work. High officers, too, will not disdain the modest and economical motorcycle and sidecar. It is not at all uncommon to meet majors and colonels traveling about in a sidecar of Italian, English or American make.

### Staff Cars Operated Economically

It is obvious that very close attention has been given to the problem of running the staff-car service as economically as possible, consistent with efficiency. One example of this is to be found in the comparatively small number of luxurious closed bodies. There is another example in the establishment of motorbus services for officers at the front. It would be possible to mention half a dozen important military positions at the front, with no railroad within 10 miles, which have a regular motorbus service for officers. The buses, which are usually 25-hp. Fiats, with closed bodies carrying eighteen passengers, make round trips—going to the front by one route and back by another—and work to a regular time table. Their objective is usually some point only a couple of miles behind the trenches, and of course liable to shell fire. This, however, does not prevent a wonderfully regular service being maintained. Officers are carried back to some important railroad depot, or can descend en route and continue their journey, if necessary, by train. This system is very effective, and avoids a reckless and indiscriminate use of touring cars for taking officers to and from the front. War experience on all fronts has shown that there is always danger of automobile extravagance among officers who will do everything possible to get the private use of a car, or, having a car, will employ it where more economical means of transportation are available. This objection, however, cannot be levied against the Italian army.

### Truck Services Divided Into Parks

Truck services for the various Italian armies in the field are divided into "parks," each one comprising as far as possible vehicles of a similar type and make, and garaged in the majority of cases in some big open space. Many of these big parks, comprising, probably, a couple of hundred trucks, are without any cover whatever, all work being done in the open. Each park has attached to it an automobile workshop with power-driven lathe, drilling machine, grinder, etc. Although not usually under shell fire, these parks must be kept as near to the front as possible and must be capable of moving at very short notice, according to military operations. It is on this account that it is a difficult matter to erect even temporary shelters. The best that can usually be done is to put the automobile repair shop alongside some building which can be used as a garage and extend a roof to cover it, thus making it possible to do the more delicate work with reasonable protection from the elements.

There are separate and entirely independent parks for the tractors used in the haulage of heavy artillery, and as these are required to move their positions less frequently, corrugated-iron roofs are erected to give protection to each vehicle, but the facilities for repairs are not usually any better than those for the ordinary trucks.

The first really important permanent repair shops are to be found at various points about 20 miles to the rear of the firing line. This is a very convenient distance to meet all requirements, for it is obvious that only a fraction of the automobiles are maintained immediately behind the trenches. No work is too important for these permanent repair shops, for they are established as far as possible in some factory and are provided with power and all necessary machinery. All general repairs which are beyond the scope of the traveling workshops are sent here to be treated. At these depots, too, supplies are maintained for all vehicles in service, and arrangements are made whereby spare parts can be sent out to the units in

A Fiat traveling repair shop

service as required. Although employing military labor only, there is no essential difference between the management of these repair shops and that of civilian establishments doing the same class of work. A close control is kept of all work done, the cost being debited to the particular section for which it was executed, so that it is always known what amount has been spent for repairs and renewals for any particular convoy, or any particular vehicle.

**Tire Distribution Controlled**

Pneumatic tires are distributed from central stores, sometimes connected with the repair depots, to the various sections in the field, but not to individual cars. These sections keep a small reserve at their headquarters, the officer in charge distributing them to the individual drivers as required. All used tires and tubes have to be returned to the depot, and at certain intervals the tires issued must balance the returns, plus the reserve stock carried. It is impossible to control the use of tires at the front as carefully as is done by taxicab and transport companies, for instance. Nevertheless, some control is possible, for the officer in charge of the section must keep an approximation of distance covered and, the exact number of tires issued being known, an average mileage is obtained. No attempt is made to repair tires and send them back for use on front-line service, although it is quite possible that repaired tires are issued to convoys working further in the rear. The different sections make use of tire gaiters and repair their own inner tubes, but they are not fitted for repairs to casings.

It is rather difficult to get an accurate estimate of the life of tires, but from acquaintance with several sections using 1 and 1½-ton pneumatic-tired trucks, the life would be fixed at not more than 3000 miles. This estimate is for vehicles working close to the front, where roads are made and repaired by dumping rough material, leaving it to the vehicles to roll that material in, and covers tires used to the limit by means of liners.

**Standardization of Tire Sizes**

Standardization of tire sizes has naturally followed the number of types of cars, although there does not appear to have been any serious attempt to make different manufacturers conform to a common standard. The sizes most commonly employed are 880 by 120 mm. (34 by 4.7 in.) and 820 by 120 mm. (32 by 4.7 in.). The former size is employed for all the pneumatic-tired trucks, and the latter for the bigger touring cars. There are two other sizes used for the smaller touring cars. The number of sizes employed remains high by reason of the presence of many converted touring cars employed in ambulance service. The bulk of the work, however, is done on three sizes of tires, and it would not be a difficult matter to limit the entire army to these three sizes. Practically all the pneumatic tires are of Italian origin, being made by Pirelli or Michelin. American pneumatics are rare, although American solid tires are a common feature on trucks.

With thousands of automobiles in service, it might be thought that full advantage would be taken of bulk storage of gasoline. This, however, is difficult on any front and almost impossible among the Italian forces. At various points to the rear, where automobiles are employed in aiding to build permanent defences, or where convoys carry goods or ammunition from the factories to the railroad depot, permanent gasoline storage tanks can be installed and tank wagons can be used to advantage. But in the zone of active operations the necessity for mobility makes these permanent installations impossible and leaves the old-fashioned tin or galvanized-iron can in possession. One motor-ambulance section, for instance, changed its quarters eight times in 7 days during the fighting of last August, and each time new quarters were taken up it was never known whether they would be occupied for days or hours. Doubtless the same changes were imposed on other sections, thus making it impossible to have more than the most meager permanent fittings. All gasoline, which, incidentally, is of American origin, is sent to the front in metal drums of 11 or 5½-gal. capacity. The smaller size is much more convenient for general handling and can be emptied into tanks with less waste.

Admittedly the system is not ideal, for it calls for many thousands of cans, all of which are subject to rough handling, are apt to leak, and are often destroyed. The mere cost of making these cans, filling them, sealing them and keeping them in repair must be a very important item where several thousand cars are in service. It is difficult, however, to devise a more satisfactory scheme for those automobile services always on the move or liable at any moment to change their quarters. It is this fear of finding quarters removed and discovering that supplies have not been brought up which causes every driver to desire to carry as big a reserve as possible. In the big permanent garages at the rear Bowser tanks with self-measuring instruments are fitted, and a record kept of all fuel supplied to every car.

**Postal Service 95 Per Cent Automobile**

Conditions rarely make it possible for any one service to be exclusively automobile. Yet there are certain supplies which are 95 per cent automobile hauled. One of these is the postal service in the zone of operations. Where the train service stops, in many cases as much as 20 miles back of the actual firing line, the mails are picked up by automobiles and carried to the headquarters of the various divisions in the field. For this work light 12-hp. cars, with a small body not overhanging the frame members, are used. By reason of their low weight, absence of overhang and correct distribution of weight, these little postal cars can take advantage of every gap in the traffic and maintain a higher average speed on the crowded roads to the front than is possible with automobiles of much greater power and size. The final distribution to the battalions, companies or batteries in the field is made by hand, but so rapid is the automobile service that the final distribution in the trenches often takes place only a few hours after the arrival at the railroad post office.

Water is also 95 per cent automobile hauled. On the Carso position, a wild, barren, sun-scorched plateau with practically no vegetation, not a drop of water is to be found. Also at many other portions of the front the local water supply is not only scarce but of such a doubtful

character that troops are forbidden to touch it. Thus the great majority of troops in the zone of operations are dependent on outside supplies of water. It is brought from town supplies in the rear by means of automobile tank wagons having a carrying capacity of 800 gal. These wagons have a power-driven pump, enabling them to discharge into receptacles which cannot be filled by gravity flow. Huge wood barrels, of the type commonly employed for beer and wine, are placed at suitable points, such as reserve camps just behind the lines, in the vicinity of batteries, among the wrecked cottages in which troops are billeted, and also very frequently in summer time by the side of roads over which large bodies of troops have to pass. These tanks are clearly marked "drinking water," and are much appreciated by the troops. From these barrels there is a final distribution, which may take many forms, right to the troops in the firing line. Sometimes this final distribution is by a small, light, two-wheeled mule wagon containing 15 to 20 gal.; sometimes it is carried in a metal vessel slung on a pole and handled by two men; frequently in the mountain districts the water is carried in leather bags on the backs of mules. Until this matter was given close attention and a systematic service organized whereby automobiles could be relied on to take to the front all the water required for drinking purposes, there was a considerable amount of disease traceable to the drinking of contaminated water.

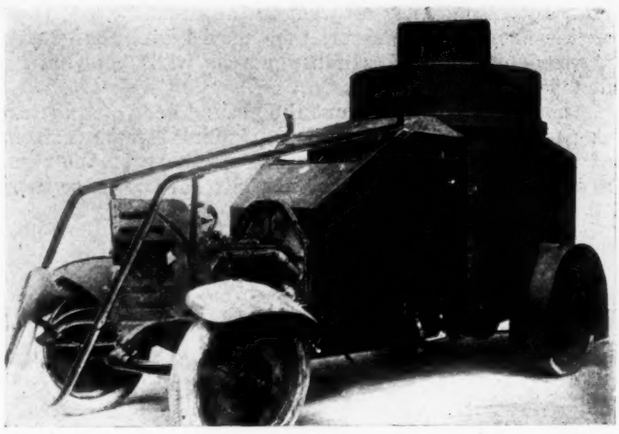
### Handling of Supplies

Whether the food supply is hauled over the rail or the road depends entirely on conditions and location. Where the railroad exists and can be relied on for a regular service, storehouses or "susestenza" are established in proximity to the depot. These stores are very roughly built sheds, often erected in an open field, within which can be found everything from quarters of beef to cigarettes. Each shed deals in one commodity, and the men who are told off to draw rations arrive with all kinds of vehicles from automobile trucks to mule carts, and present their order sheets signed by the rationing officer, at each shed in turn.

Nearer the lines, where no trains can penetrate, the supplies are taken up by automobile and placed in some wrecked building which has been roughly transformed into a store. The officers and men in charge of these stores distribute to the companies on presentation of an order form, as in the case of the bigger stores at the rear.

### Trucks Bring Luxuries to Trenches

A rather familiar sight on the roads leading to the front is automobile trucks bearing the words "Unione Militaire, Service to the Trenches." In Italy, as on all other fronts, officers and men are anxious to supplement their rations by extras not figuring on the government list. In many cases, even when not actually in the trenches, it is impossible to spend a cent, for the simple reason that there are no stores and no goods. In the zone a little farther to the rear stores are rare, and owners take advantage of the monopoly to raise prices to unreasonable limits. The Italians have therefore established official co-operative stores and opened branches in all the zones occupied by the troops. The "Service to the Trenches" does not imply that the goods are taken direct to the men sitting behind rifles in the firing line, but they are delivered at various stores established in wrecked villages immediately to the rear of the lines. Thus, while they are actually in the trenches, officers and men can have brought to them extras which may comprise anything from fresh fruit to fancy wines. Some of the stores carry dry goods and will deliver a variety of goods varying from sewing cotton to trench boots, at prices which are fixed by decree, and are generally no more than would be paid for the same goods outside the war zone.



A Lancia armored car which suffered a direct hit by a shell through its radiator

With regard to sleeping accommodation and food, men in the automobile services never experience the extremes of comfort or discomfort which fall to the lot of men in some other branches of the service. It is rarely that they are sufficiently stationary to be able to requisition mattresses or bedsteads. On the other hand, they never have to sleep on the ground, for any kind of automobile, whether it be a touring car or a truck, can be made into a dry if not a warm bedroom. Meals may not arrive with the same regularity as to the men in the heavy artillery and other semi-stationary services, but the automobile driver, being unlimited in his carrying capacity, need not go hungry if the ordinary supply fails.

### Drivers Seek Temporary Homes

Automobile drivers endeavor, as far as possible, to secure some building, or at any rate some wreckage of a building which they can regard as home. There is remembrance, for instance, of men attached to automobile searchlights, which every evening were taken up to positions among their own trenches so as to flash a light across the enemy's lines. They had to live near their "work," and the best location was discovered in a wrecked farm which had reserve trenches under and around it and barbed wire in its disreputable courtyard. Those windows looking on to the enemy's lines were boarded up one night, so that no man would be tempted to look out and thus attract the attention of the guns; two rooms were found to be fairly dry, and were equipped with bedsteads made of trestles with wire netting spread across them. When hay is thrown across this a bed is formed on which a tired soldier can always pass dreamless hours. The courtyard was large enough to house the cars, and with branches of trees laid across them during the day there was little danger of their being spotted by aeroplanes.

### Final Refuge in Dugout

A Red Cross section which had moved into a captured town with the infantry selected a very desirable villa, officially staked their claim, and prepared to live well, with a whole bedroom and a real bed for each man. They left their cars in the street, under the shelter of a church, but the enemy began to shell the town, and, as their own batteries had established themselves in the neighborhood, the automobilists received much attention. The men on the third floor found it prudent to move to the second;

from the second they all went to the ground floor; then, as the shells came nearer, they moved into the cellars, propped up the roof, sandbagged the walls, and built a dugout.

Another group picked out the ground floor of a picturesque little cottage with a clear, rippling stream in front of it. The fact that there was a mortuary on the right and an army coffin maker on the left did not cause them to hesitate in their choice. But after one night they moved out, declaring that they could not face being eaten alive by rats. During the summer months, at any rate, many drivers of trucks and ambulances make a rule of sleeping aboard their vehicles. The practice simplifies life considerably, for there are no quarters to seek, no fear of getting another man's bunk, and no insects or animals to disturb the peacefulness of the night.

# Through-Traffic Road Suggested by THE AUTOMOBILE Meets Further Approval

### Prominent Road Engineers Continue to Write Their Indorsements and Many Propose Improvements on the Original Design

MEN whose opinions carry weight in road engineering circles and who are prominent in various branches of industry are finding the through-traffic motor highway, suggested in THE AUTOMOBILE for April 5, a matter of live interest and very pertinent in view of present national developments. Ever since the publication of the article announcing that General Goethals, builder of the Panama Canal, had accepted the appointment as chief engineer of the State of New Jersey and suggesting a modern motor highway linking New York and Philadelphia as a task worthy of his ability and previous achievements, letters have been pouring in from all sections of the country expressing commendation of the project and offering valuable ideas for working out the details. All of these men realize that present traffic congestion is but the beginning of what may be expected when our motor vehicle registration is two or three times its present total of three and a half million.

**A Three-Track Roadway**

The road suggested by THE AUTOMOBILE as the first step in a nation-wide recognition of the advanced type of highway construction which the traffic problems of the future will render imperative may be summarized as follows. Three parallel roadways totaling 100 ft. in width, the two outside tracks to be used by automobiles which will travel in only one direction and the center space to be used for motor trucks with travel in both directions. Each of the automobile tracks would have room for three or four cars abreast and the truck roadway would be wide enough to admit of three trucks traveling abreast.

Advantages pointed out by the engineers who have studied the plan are: higher speed with less danger of collision; greater safety for pedestrians, resulting from segregation of motor traffic; elimination of grade crossing and more efficient and economical operation of both cars and trucks.

**Letters from Prominent Men**

Among the letters received this week were communications from Coleman du Pont; William H. Connell, chief of Bureau of Highways of Philadelphia; G. E. Parisoe, president Wyoming Good Roads Assn., and L. W. Page, director Office of Public Roads and Rural Engineering, United States Department of Agriculture. Digests of some of these letters received follow:

## Maintenance a Necessity—Connell

YOUR statement that the automobile highway linking New York and Philadelphia, proposed in THE AUTOMOBILE for April 5, should be kept continuously in good repair is not only commendable, but is a necessity. Under present conditions the roads under the jurisdiction of the State Highway Department of New Jersey are usually in good repair, but the roads through many of the townships and cities are not kept in as good condition as elsewhere. One consequence of this state of affairs, which is by not means peculiar to New Jersey, is that the cost of maintenance of automobiles and motor trucks which are operated over those roads is greatly increased.—WILLIAM M. CONNELL, *chief of Bureau of Highways, Philadelphia.*

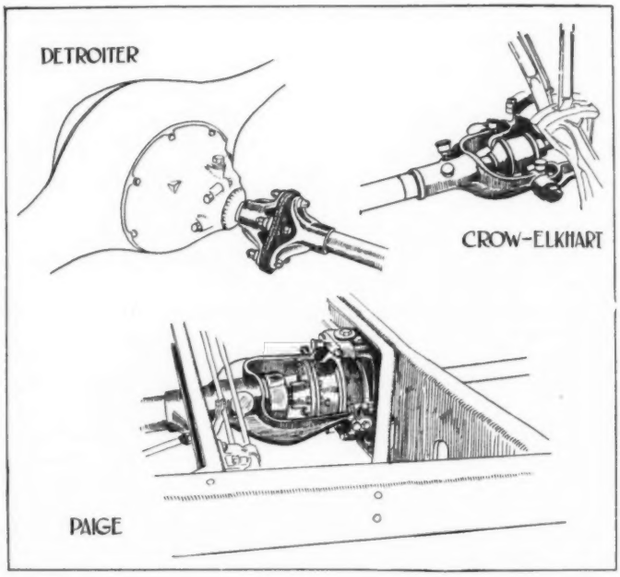
## Needs Two More Approaches—du Pont

THE idea of the motor highway would be materially improved with two more ways of getting on to it. In other words, the vehicles desiring to get off on one side must cross in front of traffic going both high speed and low speed, whereas if you had two more approaches this would avoid crossing the high-speed traffic.—COLEMAN DU PONT.

## A Step Forward in Roads—Parisoe

THE modern high traffic road suggested in THE AUTOMOBILE for April 5 should represent a step forward in road construction in the United States. It has been my privilege as president of the Wyoming Good Roads Assn. to prepare a State highway bill and to see it successfully through the State Legislature and signed by the Governor, although our organization had a hard time in winning.—J. E. PARISOE, *president Wyoming Good Roads Assn.*

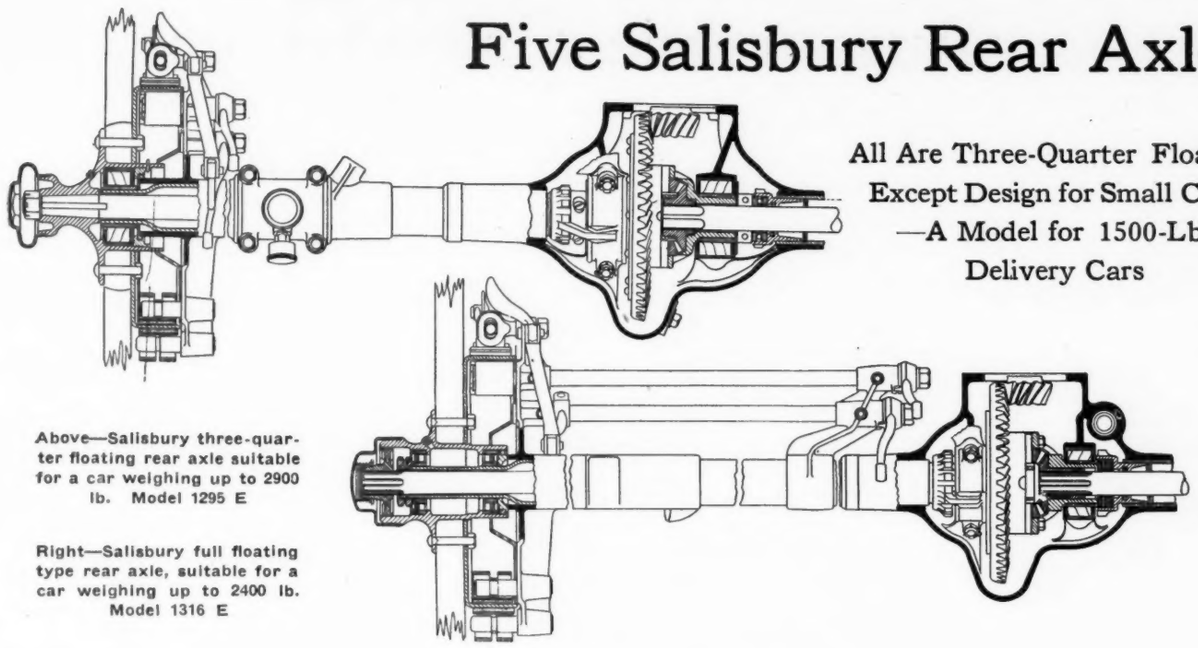
## Details of Design




Universal joint mountings on Detroiter, Crow-Elkhart and Paige cars, illustrating divergence of engineering practice

# Five Salisbury Rear Axles

## All Are Three-Quarter Floating Except Design for Small Cars —A Model for 1500-Lb. Delivery Cars



Above—Salisbury three-quarter floating rear axle suitable for a car weighing up to 2900 lb. Model 1295 E

Right—Salisbury full floating type rear axle, suitable for a car weighing up to 2400 lb. Model 1316 E

THE axle line made by the Salisbury Wheel & Axle Co., Inc., of Jamestown, N. Y., includes five models. The smallest is a floating type suitable for cars weighing up to 2400 lb., and the largest of the passenger car line is a three-quarter floating type suitable for cars weighing up to 3700 lb. There is also an axle suitable for a delivery truck of 1500 lb. capacity used in connection with pneumatic tires. The Salisbury company uses the floating type only for its small passenger car axle, all the others being three-quarter floating.

The smallest axle of the line, known as No. 1316 E, follows conventional floating practice quite closely, with the wheel located between the two bearings at the hub. The load of the car is supported upon the axle tube housing by means of Bower roller bearings. The drive is transmitted through the spline end of the axle drive shaft to the wheel hub.

### The Standard Design

The standard axle has a spring center distance of 37⅜ in. with standard 56 in. tread. The pinion drive is through a spiral bevel with 5.5 pitch gears having a 14.5 deg. pressure axle. The pinion is adapted to a 1-in. propeller shaft and is fastened by means of a taper of 2 in. per foot with a .25 by .125 in. key-way. The axle drive shaft is splined at both inner and outer ends and may be removed in the customary manner by taking off the rear hub cap. There is a spring retaining member beneath the cap, the spring being compressed by tightening the cap.

The next larger axle is Model 1295 E, which is a three-quarter floating type suitable for a car weighing up to 2900 lb. In this axle, the roller bearing carrying the load is mounted on the outer end of the axle tube in the center line of the wheel. The drive is taken through the hub by means of a taper key fitting. This axle has a spiral bevel drive with the drive pinion adapted to be mounted on the end of a 1.25 in. propeller shaft. The teeth on the ring gear are 5-pitch with a 14½-deg. pressure angle. The drive is transmitted through the splined inner end of the axle shaft, the latter being supported on a large roller bearing, and an annular thrust bearing at its inner, with roller bearings for the hubs. The tubular housing on this rear axle is fitted with radius rods at its outer end and also with spring perches provided with grease cups. It is adapted for 39 in. spring centers. The Model 1247 E is the same as 1295 E with the exception of the brake size. In this instance it is 14 in., whereas on the 1295 E it is 12 in.

The next largest model is the heaviest passenger car axle made by the Salisbury company and is a three-quarter floating type, known as 1288 E. It is suitable for cars weighing up to 3700 lb. In general design, this axle is similar to the smaller three-quarter floating types. It is carried on the same style of roller bearings, mounted in a similar way, but adapted for a 1⅜-in. propeller shaft. The spring center distance is 40½ in., and the wheel spokes are 1½ in. The spiral bevel drive has a 5-pitch tooth with a 14½-deg. pressure angle. It has ¾-in. radius rod fittings and a 3¾-in. spring perch fitted with grease cups.

The Model 1230 E three-quarter floating axle, suitable for 1500 lb. delivery wagons, differs from the other three-quarter floating types in some of its design features. It has a straight bevel drive of 5-pitch and a tread of 56 in. The axles are supported at both the inner and outer ends in accordance with customary three-quarter floating practice, with heavy-duty Hyatt bearings in the center line of the wheel and at the inner end of the axle shaft. There is a ball thrust also at the inner end and ample washer provision to provide against leakage to the axle drums. The lubricant thrown from the driving ring gear flows to the wall in the bottom of the differential case. The spring center distance on this axle is 40 13/16 in., the perch being provided with a 3¾ in. spread between longitudinal bolts and 3 19/32 in. between transverse bolts.

### All Are of Built-Up Type

The three-quarter floating axles above outlined are all of the built-up type, having cast parts of malleable iron with a tensile strength of 50,000 lb. per square inch. The differential housing is cast in one piece, while the spring perches, brake supports and brake shaft brackets are machined and assembled on the axle tubes. The latter are made of cold drawn seamless steel tubing, and the shafts are heat-treated chrome nickel steel with an elastic limit of 105,000 lb. The shaft ends are machined for a standard six-spline fitting for the differential side gears and a ground taper fitting for the rear hubs which are pressed on this taper fitting by means of a square key and nut. To take the side thrust of the wheels it is necessary to have a thrust bearing for the shafts. It is located in the differential housing, where it also takes the thrust loads of the differential.

On each shaft there are split clamping collars, which are bound together with two screws, located between the ends of the differential and thrust bearings. They have a series of grooves which coincide with the grooves in the driveshaft and when clamped together retain the shafts in a fixed location.

# Automobile Calendar

### CONTESTS

1917

May 10—Uniontown, Pa., Speedway Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Cincinnati, Ohio, 250-Mile Race.
May 30—Uniontown, Pa., Local Races.
June 9—Chicago, Ill., Speedway Race.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 4—Uniontown, Pa., Speedway Race.
July 4—Tacoma, Wash., Speedway Race.
July 4—Visalia, Cal., Road Race
July 4—Spokane, Wash., Track Race.
July 4—Benton Harbor, Mich., Track Race.
July 14—Rochester, N. Y., Hillclimb.
July 15—Missoula, Mont., Track Race.
July 17-19—Buffalo, N. Y., Intercity Reliability.
July 22—Anaconda, Mont., Track Race.
July 29 — Great Falls, Mont., Track Race.
Aug. 5—Billings, Mont., Track Race.
Aug. 17—Flemington, N. J., Track Race.
Sept. 3—Uniontown, Pa., Speedway Race.
Sept. 3—Cincinnati, O., Speedway Race, Championship.
Sept. 6—Red Bank, N. J., Track Race.
Sept. 8—Hillclimb, Pike's Peak, for stripped stock chassis.
Sept. 15—Providence, R. I., Speedway Race, Championship.
Sept. 22—Allentown, Pa., Track Race.
Sept. 28—Trenton, N. J., Track Race.
Sept. 29—New York Speedway Race, Championship.
Oct. 6—Danbury, Conn., Track Race.
Oct. 6—Uniontown, Pa., Speedway Race.
Oct. 13—Richmond, Va., Track Race.
Oct. 13—Chicago Speedway Race, Championship.
Oct. 27 — New York Speedway Race.

### SHOWS

April—Milwaukee, Wis., Spring Show, Milwaukee Automobile Dealers.
April 20-26 — Milwaukee, Wis., Used Car Show, Milwaukee Automobile Dealers, Auditorium.
April 23-28 — Superior, Wis., First Annual Superior Show, Truax Block. W. T. Daley, manager.
Aug. 6-18—Fremont, Neb., General Tractor Demonstration.
Sept. 2-9—Spokane, Wash., Interstate Fair.
Sept. 9-15 — Milwaukee Show, State Park Fair, West Allis.
Sept. 9-15 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, West Allis, Milwaukee Automobile Dealers.

# S. A. E. Calendar

## Midsummer Meeting

June 25—Washington, D. C.

## Standards Division Meetings

### MAY

1-2—Research, Hotel Statler, Cleveland.
2—Lighting, National Elec. Lamp Works, Cleveland.
2—Iron and Steel, Hotel Statler, Cleveland.
2—Transmission, Hotel Statler, Cleveland.
3—Tractor Standards, Hotel Statler, Cleveland.
3—Standards Committee, Hotel Statler, Cleveland.
4—Electric Vehicle, Hotel Statler, Cleveland .
4—Marine Standards, Hotel Statler, Cleveland.
16—Ball and Roller Bearing, New York.
18—Truck Standards, New York.
22—Lighting, Cleveland.
25—Aeronautic, New York.
25—Miscellaneous, Detroit.
29—Research, New York.

### JUNE

5—Starting Battery, Detroit.
7—Engine, Detroit.
8—Transmission, Detroit.
14—Electric Vehicle, New York.
18—Standards Committee.

## Section Meetings

### APRIL

30—Detroit — Annual Business meeting.

### MAY

11—Detroit.
17—Metropolitan, Engines that Will Burn the Fuels We Shall Have to Use. Papers by H. G. Chatain on the Diesel and P. O. Scott on the Junker.

# Engineering Calendar

American Railway Master Mechanics' Assn.
American Institute of Electrical Engineers.
Master Builders' Assn.
American Society of Heating and Ventilating Engineers.
Association Iron and Steel Electrical Engineers.
Mining and Metallurgical Society of America.
Society of Automobile Engineers.
Illuminating Engineering Society.
National Electric Light Assn.
National Gas Engine Assn.
American Society for Testing Materials.
American Institute of Metals.
American Foundrymen's Assn.
Society Naval Architects and Marine Engineers.

### MAY

5—Assn. Iron & Steel Elec. Engrs., Majestic Hotel, Philadelphia. Some Recent Applications of Electricity in the Steel Industry by G. E. Stoltz.
8—Soc. for Elec. Development annual meeting.
12 — Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
15—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
17—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penna. section at Phila.
17—Mining & Met. Soc. of Amer. monthly meeting New York section at Engrs. Club.
18—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
19—Assn. Iron & Steel Elec. Engrs., Fort Pitt Hotel, Pittsburgh. Auspices of Power Committee, W. O. Oschmann, chairman. Power Cost Accounting Systems as Practised by Several Steel Mills in Pittsburgh District.
21—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
21-24—Amer. Soc. Mech. Engrs. Spring meeting in Cincinnati. Joint session May 22 with Nat. Mach. Tool Bldrs. Assn.
29-June 1 — Nat. Elec. Light Assn. Convention at Atlantic City.

### JUNE

2—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
5-7—Nat. Gas Engine Assn. annual meeting at Chicago (Sherman House).
8—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
9—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
13-14-15 — Amer. Ry. Master Mech. Assn. convention, Greek Temple, Atlantic City, N. J. Hdqrs. Marlborough-Blenheim Hotel.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
15—Illum. Eng. Soc. Pittsburgh section, Office Building, Lighting and Inspection Trip through City and County Building. Mr. S. G. Hibben.
16—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
18-19-20 — Master Car Bldrs. Assn. convention, Greek Temple, Atlantic City, N. J. Hdqts. Marlborough-Blenheim Hotel.
20-22—Amer. Inst. Chem. Engrs., Ninth Semi-Annual Meeting at Buffalo.
21—Mining & Met. Soc. of Amer. New York section monthly meeting at Engrs. Club.
26-30—Amer. Soc. for Test Mat. annual meeting Atlantic City.

### JULY

7—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
14—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
16—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
21—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.

### AUGUST

4—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
11—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
20—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
21—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.

### SEPTEMBER

1—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
10-14—Assn. Iron & Steel Elec. Engrs. annual convention at Phila.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
14—Amer. Soc. Heat & Vent. Engrs. monthly meeting Ohio section at Cleveland.
15—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
17—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
20—Mining & Met. Soc. of Amer. monthly meeting N. Y. section at Engrs. Club.
24—Amer. Inst. Metals at Boston.
24—Amer. Fdry. Assn. annual meeting at Boston.

### OCTOBER

6—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.